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THE UNIVERSITY OF ALBERTA

TESTING AND THE ELEMENTARY MATHEMATICS PROGRAM IN ZONE ONE: A SCHOOL SYSTEM APPROACH

by

© ALVIN LEONARD ANDERSON

A THESIS
SUBMITTED TO THE FACULTY OF GRADUATE STUDIES AND RESEARCH
IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE DEGREE
OF DOCTOR OF PHILOSOPHY

ELEMENTARY EDUCATION

EDMONTON, ALBERTA
FALL, 1979

THE UNIVERSITY OF ALBERTA

FACULTY OF GRADUATE STUDIES AND RESEARCH

The undersigned certify that they have read, and recommend to the Faculty of Graduate Studies and Research, for acceptance, a thesis entitled TESTING AND THE ELEMENTARY MATHEMATICS PROGRAM IN ZONE ONE: A SCHOOL SYSTEM APPROACH submitted by ALVIN LEONARD ANDERSON in partial fulfilment of the requirements for the degree of DOCTOR OF PHILOSOPHY in ELEMENTARY EDUCATION.

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ABSTRACT

It seems apparent that if a curriculum development is undertaken, at whatever level, that the evaluation process must be extended to the content, procedures, and presuppositions that were chosen during the developmental stage. This would also apply if it were the implementation of a curriculum that was of concern.

If however the focus is to be that of the student, in assessing his or her understanding of a particular subject, then perhaps one can do more than implicate the development and implementation of the curriculum in question.

This in fact was the approach taken in this study. Although some evaluative implications for the program were revealed, one of the main purposes was to assess pupil knowledge and understanding of the elementary mathematics objectives in the Program of Studies for Elementary Schools (1978).

Over 12 000 students in each of 1978 and 1979 were administered tests which were criterion referenced to the Alberta program. The data collected were also to provide teachers and supervisors with the diagnostic information that could make instruction more purposeful.

Besides collecting pupil scores for objectives within the Number, Operations and Properties, Measurement, Geometry, and Graphing strands for each grade level, other variables such as age of entry to school, sex, geographical

location and sectarian (Public-Separate) placement were examined.

Mathematics achievements in the primary grades may be considered as a success experience for the majority of students. Certainly the children who are coming to and completing grade one appear able to handle their program.

There are however the hints of student weaknesses, at the grade one year, which may have an impact on the lower achievement in the higher grades. For example the important concept of place value haa a weak start in grade one.

Metric measurement as a system has not been successfully implemented, particularly at the Division II level.

Many students experienced difficulty with such topics as using coins for purchasing things, writing time, writing ordered pairs and proportional ratios, understanding decimals, multiplying and dividing numbers, and constructing graphs.

Performance in problem solving was consistently low throughout the grades.

The achievement of the early and late starters in school was similar for the first three years. From grade four and beyond however, the pupils who had started school older than 6.0 years did consistently better in virtually every area of the program.

Public school students outperform Separate school students and vice versa in about the same number of situations. The Separate students appear to have made the greater gains for 1979 however.

Another important aspect of this study was the Zone One teacher's interpretations of student achievement in 1978. These teachers considered the mismatch of the authorized textbooks with the program, and the failure of students to master the mathematics concepts because of inadequate learning skills, as the primary reasons for more students not being able to reach the 85-100 percent achievement category.

Concerning the main problem areas within the strands, teachers thought that the difficulties in the Number and the Operations and Properties strands were due to the students not mastering the previous prerequisite concepts. Teachers believed that the failures within the Measurement, Geometry, and Graphing strands were due to the lack of instructional emphasis that would be required for students to succeed.

ACKNOWLEDGEMENTS

As this research project comes to a conclusion one cannot help but be reminded of the contributions of so many people.

The first thanks goes to Dr. George Cathcart my adviser; for his patience, encouragement and the continuous giving of his time to my total program.

Thanks also to the supervisory committee Dr. T.P. Atkinson, Dr. T.O. Maquire and Dr. A.T. Olson. Their constructive criticism and assistance were influential in the focus which this research was to take, that of a field study.

The work of the teachers and supervisors from the 141 schools in 22 schools systems is sincerely appreciated. The hours of testing, correcting and transferring of data in particular came at a very busy time of year.

The programming efforts of Mr. T.C. Montgomerie and Mr. D. Wodelet from the Division of Educational Research were much appreciated.

A special thanks is due Alberta Education for the granting of educational leave and to the Grande Prairie School Division for their handling of the many administrative details in the project.

Finally to my wife Darlene, daughter Kyla and son, Fraser, I give you my love and thanks for your giving of many seasons so that this work would reach fulfilment.

Table of Contents

Chapter Page

CHAPTER I

INTRODUCTION TO THE PROBLEM..........................1

A. BACKGROUND TO THE PROBLEM.........................3

B. STATEMENT OF THE PROBLEM..........................6

C. HYPOTHESIS..7

Hypothesis One.................................7

Hypothesis Two.................................7

Hypothesis Three...............................8

Hypothesis Four................................8

Hypothesis Five................................8

Hypothesis Six.................................8

D. DEFINITION OF TERMS...............................8

Criterion-Referenced Measures..................8

Criterion Scores...............................9

Achievement Categories.........................9

Early Starters.................................9

Late Starters..................................9

Zone One......................................10

North Zone One................................10

South Zone One................................11

Public School Students........................11

Separate School Students......................11

E. SIGNIFICANCE OF THE STUDY........................11

F. LIMITATIONS OF THE STUDY.........................12

CHAPTER II

REVIEW OF RELATED LITERATURE........................15

A. BACKGROUND..15

B. A CHANGING SOCIETY.................................20

C. AIMS, GOALS AND OBJECTIVES.........................22

D. EVALUATION AND TESTING.............................28

E. MATHEMATICS ASSESSMENTS............................36

F. REGIONAL DIFFERENCES...............................42

G. AGE AND SEX DIFFERENCE.............................45

H. THE ZONE ONE STUDY IN PERSPECTIVE..................48

CHAPTER III

INSTRUMENTATION AND RESEARCH PROCEDURES...............49

A. INSTRUMENTATION....................................49

- Zone One Testing Instruments.......................49
- Pilot Testing......................................50

B. RESEARCH PROCEDURES................................52

- Data Collection....................................52
- Scoring Reliability................................54
- Reporting Results..................................55
- Additional Information.............................55
- Data Analysis......................................56
- Analysis of the Questionnaire......................59
- The Analysis of the Objectives.....................60

C. THE EFFECTIVENESS OF THE PRINT-OUTS................60

CHAPTER IV

GRADE ONE

ANALYSIS OF HYPOTHESIS ONE AND TWO FOR GRADE ONE..62

A. DISCUSSION OF THE GRADE ONE RESULTS................87

- Number...87

Operations and Properties....................87

Measurement....................................87

Geometry.......................................91

Graphing.......................................91

CHAPTER V
GRADE TWO
ANALYSIS OF HYPOTHESIS ONE AND TWO FOR GRADE TWO..92

A. DISCUSSION OF THE GRADE TWO RESULTS............125

Number...129

Operations and Properties.....................129

Measurement...................................130

Geometry......................................131

Graphing......................................131

CHAPTER VI
GRADE THREE
ANALYSIS OF HYPOTHESIS ONE AND TWO FOR GRADE THREE..
132

A. DISCUSSION OF THE GRADE THREE RESULTS..........173

Number..173

Operations and Properties.....................177

Measurement...................................177

Geometry......................................178

Graphing......................................179

CHAPTER VII
GRADE FOUR
ANALYSIS OF OBJECTIVES ONE AND TWO FOR GRADE FOUR180

A. DISCUSSION OF THE GRADE FOUR RESULTS...........225

Number..225

Operations and Properties.....................229

Measurement...................................229

Geometry....................................230

Graphing....................................231

CHAPTER VIII
GRADE FIVE

ANALYSIS OF HYPOTHESIS ONE AND TWO FOR GRADE FIVE232

A. DISCUSSION OF THE GRADE FIVE RESULTS...........272

Number......................................272

Operations and Properties...................276

Measurement.................................277

Geometry....................................278

Graphing....................................279

CHAPTER IX
GRADE SIX

ANALYSIS OF HYPOTHESIS ONE AND TWO FOR GRADE SIX.280

A. DISCUSSION OF THE GRADE SIX RESULTS............314

Number......................................315

Operations and Properties...................317

Measurement.................................319

Geometry....................................320

Graphing....................................320

CHAPTER X

ANALYSIS OF THE DEMOGRAPHIC VARIABLES AND THE QUESTIONNAIRE; THE ACHIEVEMENT PROFILES...........321

A. INTRODUCTION.................................321

B. RESTATEMENT OF THE HYPOTHESIS.................322

Hypothesis Three............................322

Hypothesis Four.............................323

Hypothesis Five.............................323

Hypothesis Six..............................323

C. DISCUSSION FROM THE RESULTS...................323

Grade One....................................323

Grade Two....................................329

Grade Three..................................330

Grade Four...................................334

Grade Five...................................341

Grade Six....................................342

D. ANALYSIS OF THE QUESTIONNAIRE (Appendix B)....346

E. SECTION ONE OF THE QUESTIONNAIRE.............347

F. SECTION TWO OF THE QUESTIONNAIRE.............348

G. SECTION THREE OF THE QUESTIONNAIRE...........348

H. REPORTING OF THE QUESTIONNAIRE FINDING........350

Grade One....................................351

Grade Two....................................355

Grade Three..................................360

Grade Four...................................365

Grade Five...................................370

Grade Six....................................374

I. THE ACHIEVEMENT PROFILES.....................380

J. THE USE OF THE PRINTOUTS.....................381

By teachers..................................381

By Principals................................382

Central Office Supervisors...................383

CHAPTER XI
SUMMARY, INTEGRATION, IMPLICATIONS
AND RECOMMENDATIONS...........................384

A. SUMMARY OF THE STUDY.........................384

The Instruments..............................385

Findings.....................................385

Hypothesis One............................385

Hypothesis Two............................386

Hypothesis Three (Early-late starters).....386

Hypothesis Four (Male and Female)..........387

Hypothesis Five (North and South Zone).....387

Hypothesis Six (Public and Separate Schools)..
388

B. THE QUESTIONNAIRE.............................389

Part I....................................389

Part II...................................390

Part III..................................390

C. INTEGRATION OF THE STUDY FINDINGS.............391

The Zone One Tests........................391

Student Achievement.......................393

D. IMPLICATIONS FOR THE CURRICULUM..............395

E. RECOMMENDATION FOR FURTHER RESEARCH...........396

References...398

LIST OF TABLES

Table Page

1. Number of Objectives in Each Grade Level..........

2. Administration Schedule for Piloting Tests........

3. Comparing Teacher and Researcher Scoring of Twenty-Four Sample Tests in Each of Three Grades

4. A Typical Student Prifile.........................

5. Percentage Means For Grade One Students in Zone One for 1978 and 1979...............................

6. Achievement Means in 1978 and 1979 Within Categories A-D. For Number, Operations and Properties, and Measurement Strands...............

7. Achievement Means in 1978 and 1979 Within Categories A-D for the Geometry and Graphing Strands...

8. The 1978 and 1979 Zone One Mean Scores for Grade Two by Objectives and Strands......................

9. Achievement Means in 1978 and 1979 Within Categories A-D for the Number, Operations and Properties and Measurement Strands...............

10. Achievement Means in 1978 and 1979 Within Categories A-D for the Geometry and Graphing Stands..

11. Percentage Means for Grade Three Students in Zone One for 1978 and 1979.......................

12. Achievement Means in 1978 and 1979 Within Categories A-D for the Number, Operations and Properties and Measurement Strands................

13. Achievement Means in 1978 and 1979 Within Categories A-D for the Geometry and Graphing Strands..

14. The 1978 and 1979 Zone One Mean Scores for Grade Four by Objectives and Strands...................

15. Achievement Means in 1978 and 1979 Within Categories A-D for the Number, Operations and Properties, and Measurement Strands...............

16. Achievement Means in 1978 and 1979 Within Categories A-D for the Geometry and Graphing Strands..

17. The 1978 and 1979 Zone One Mean Scores for Grade Five by Objectives and Strands...................

18. Achievement Means in 1978 and 1979 Within Categories A-D for the Number, Operations and Properties, and Measurement Strands...............

19. Achievement Means in 1978 and 1979 Within Categories A-D for the Geometry and Graphing Strands..

20. The 1978 and 1979 Zone One Mean Scores for Grade Six by Objectives and Strands...................

21. Achievement Means in 1978 and 1979 Within Categories A-D for the Number, Operations and Properties, and Measurement Strands...............

22. Achievement Means in 1978 and 1979 Within Categories A-D for the Geometry and Graphing Strands..

23. Comparison of Subgroup Mean Scores in Zone One for Grade One Number, Operations and Properties,

and Measurement..

24. Comparison of Subgroup Mean Scores in Zone One for Grade One Geometry and Graphing................

25. Comparison of Subgroup Mean Scores in Zone One for Grade Two Number, Operations and Properties, and Measurement..

26. Comparison of Subgroup Mean Scores in Zone One for Grade Two Geometry and Graphing................

27. Comparison of Subgroup Mean Scores in Zone One for Grade Three Number, Operations and Properties, and Measurement......................

28. Comparison of Subgroup Mean Scores in Zone One for Grade Three Geometry and Graphing.............

29. Comparison of the Subgroup Mean Scores in Zone One for Grade Four Number, Operations and Properties, and Measurement......................

30. Comparison of the Subgroup Mean Scores in Zone One for Grade Four Geometry and Graphing..........

31. Comparison of the Subgroup Mean Scores in Zone One for Grade Five Number, Operations and Properties, and Measurement......................

32. Comparison of the Subgroup Mean Scores in Zone One for Grade Five Geometry and Graphing..........

33. Comparison of the Subgroup Mean Scores in Zone One for Grade Six Number, Operations and Properties, and Measurement......................

34. Comparison of the Subgroup Mean Scores in Zone One for Grade Six Geometry and Graphing...........

35. Frequency of Grade One Teachers in Experience Categories Choosing Factors that Influence

Non-Mastery Performance..........................

36. Frequencies of Grade One Teachers in Experience Categories Choosing actors that Influence Mathematics Programs..........................

37. Frequencies of Grade One Teachers in Experience Categories Choosing Reasons for Lowest Means by Strand..........................

38. Frequencies of Grade Two Teachers in Experience Categories Choosing Factors that Influence Non-Mastery Performance..........................

39. Frequencies of Grade Two Teachers in Experience Categories Choosing Factors that Influence Good Mathematics Programs..........................

40. Frequencies of Grade Two Teachers in Experience Categories Choosing Reasons for Lowest Means by Strand..........................

41. Frequencies of Grade Three Teachers in Experience Categories Choosing Factors that Influence Non-Mastery Performance..........................

42. Frequencies of Grade Three Teachers in Experience Categories Choosing Factors that Influence Good Mathematics Programs..........................

43. Frequencies of Grade Three Teachers in Experience Categories Choosing Reasons for Lowest Means by Strand..........................

44. Frequencies of Grade Four Teachers in Experience Categories Choosing Factors that Influence Non-Mastery Performance..........................

45. Frequencies of Grade Four Teachers in Experience Categories Choosing Factors that Influence Good MAthematics Programs..........................

46. Frequencies of Grade Four Teachers in Experience

Categories Choosing Reasons for Lowest Means by Strand..

47. Frequencies of Grade Five Teachers in Experience Categories Choosing Factors that Influence Non-Mastery Performance............................

48. Frequencies of Grade Five Teachers in Experience Categories Choosing Factors that Influence Good Mathematics Programs...............................

49. Frequencies of Grade Five Teachers in Experience Categories Choosing Reasons for Lowest Means by Strand..

50. Frequencies of Grade Six Teachers in Experience Categories Choosing Factors that Influence Non-Mastery Performance............................

51. Frequencies of Grade Six Teachers in Experience Categories Choosing Factors that Influence Good Mathematics Programs...............................

52. Frequencies of Grade Six Teachers in Experience Categories Choosing Reasons for Lowest Means by Strand..

LIST OF FIGURES

Figure Page

1 Participating School Systems..................

2 Why Evaluate? The Evaluators Dilemma..........

3 Characteristics of Measurement, Assessment, and Evaluation.............................

4 A Typical Form Showing The Objectives, Tests Items and Analysis.........................

5 Grade One Detailed Analysis of Mark Weightings................................

6 - 22 The Grade One Elementary Mathematics Program Objectives, the Test Items Referenced to the Objectives and the Corresponding Analysis of Student Achievement...........................

23 Grade Two Detailed Analysis of Mark Weighting.....................................

24 - 50 The Grade Two Elementary Mathematics Objectives, The test Iterms Referenced to the Objectives and the Corresponding Analysis of Student Achievement................

51 Grade Three Detailed Analysis of Mark Weightings..................................

52 - 84 The Grade Three Elementary MAthematics Objectives, the Test Items Referenced to the Objectives and the Corresponding Analysis of Student Achievement..........................

85 - 86 Grade Four Detailed Analysis of Mark Weightings.................................

87 - 121 The Grade Four Elementary Mathematics Objectives, the Test Items Referenced to the Objectives and the Corresponding Analysis of Student Achievement.........................

122 - 123 Grade Five Detailed Analysis of Mark Weightings....................................

124 - 155 The Grade Five Elementary Mathematics Objectives, the Test Items References to the Objectives and the Corresponding Analysis of Student Achievement.........................

156 - 157 Grade Six Detailed Analysis of Mark Weightings....................................

158 - 184 The Grade Six Elementary Mathematics Objectives, the Test Items Referenced to the Objectives and the Corresponding Analysis of Student Achievement.........................

185 A Chart Indicating Which Subgroups in Grade 1 have Statistically Higher Achievement.......

186 A Chart Indicating Which Subgroups in Grade 2 Have Statistically Higher Achievement.......

187 A Chart Indicating Which Subgroups in Grade 3 Have Statistically Higher Achievement.......

188 A Chart Indicating Which Subgroups in Grade 4 Have Statistically Higher Achievement.......

189 A Chart Indicating Which Subgroups in Grade 5 Have Statistically Higher Achievement.......

190 A Chart Indicating Which Subgroups in Grade 6 Have Statistically Higher Achievement.......

CHAPTER I

INTRODUCTION TO THE PROBLEM

A revised mathematics curriculum was placed into Alberta elementary schools as a program of studies in September of 1977. A good deal of discussion has been centered on the implementation of this program.

Politicians and many of the general public were pleased with what they heard about the program's move towards the "basics" in whatever narrow view they perceived the change to be. Many teachers were expressing mixed feelings relative to the specification of mathematics objectives. This concern was due in part to the fact that the authorized textbooks could not be the exclusive instructional tool. For these and perhaps other reasons the extent to which the elementary mathematics program has been effectively implemented is yet to be determined.

Regardless of implementation status the program is in place as an official program of studies. The development of its scope and sequence of concepts, skills, and understandings in objective form was assigned to an ad hoc working committee under the direction of Alberta Education's Curriculum Branch and an appointed Mathematics Coordinating Committee. Program development, piloting and revision to final form took place from October 1974 through March of 1977. Over 100 schools were involved in extensive piloting of the program.

Besides presenting mathematics content in objective form within the five strands of Number, Operations and Properties, Measurement, Geometry, and Graphing at the six grade levels, other changes were to be included in the revision.

The Measurement strand was to be exclusively metric. With the metric system based on powers of ten came an accompanying emphasis on decimal fractions and a reduction in the amount of work with common fractions.

Modifications were made to the Geometry strand as well. Children's experience with 3-dimensional form was considered in removing the point-set start at the primary level. Motion geometry objectives were included for the upper elementary students.

The program as oultined was to be specified as core. This was to be accomplished by building the concepts, skills and understandings upon specified objectives and including predominantly essentials at each grade level. These were to be considered as the 'building blocks' to any and all mathematics required of students in the future.

TABLE 1

NUMBER OF OBJECTIVES IN EACH GRADE LEVEL

Grade I	Grade II	Grade III	Grade IV	Grade V	Grade VI
18	28	33	35	32	27

The number of mathematics objectives that are included for each grade level in the Alberta program are given in Table 1. The objectives are stated in full in Chapter 4 (Grade 1) through Chapter 9 (Grade 6) where the items, achievement scores and statistical analysis related to the specific objectives are contained.

A. BACKGROUND TO THE PROBLEM

The new Elementary School Mathematics Program with its objective based system of presenting content has necessitated revisions to current practices of evaluating students. Presently available standardized tests are inadequate in terms of covering the Program of Studies Objectives at every grade level of the elementary school. This statement has been verified by the Alberta Educations's Mathematics Sub-Committee Report (1976) on the assessment of various standardized tests. The following tests were examined by the group:

Canadian Test of Basic Skills, Form 3 (levels 7 to

14)

Metropolitan Achievement Test, Primary II
(Intermediate and Advanced)
Sequential Tests of Educational Progress, Series II
(Form A & Form 3A)
Stanford Achievement Test (Intermediate and
Advanced)
SRA Assessment Survey Achievement Series (Primary I,
Primary II, Blue Green and Red)

Their summary is worth noting:

> The main problem with the tests in general was not so much with what was tested and which was not in the curriculum, but what is in the curriculum and not tested. Granted, a good test need not test every objective; but a sampling from each strand should be included. Some or all of the measurement, geometry and graphing strands were either underrepresented or omitted entirely on all of the elementary tests. This is not a "fault" of the test but rather an indication of the "poor fit" with the Alberta Curriculum (Chandler, 1976,p.2)

The commonly voiced criticisms of the new program, especially with the knowledge concerning the poor fit of standardized tests, was in the area of determining the achievement levels of students, and in gauging the effectiveness of various instructional designs. The Curriculum Guide is of little help in this regard. The term "core" is used to define the minimum essentials of mathematics learning to take place at each grade level. The intent of this re-definition of curriculum was that student 'mastery' of content would not only be possible, but likely for the 'majority' of students at the elementary school level.

Neither of the terms mastery or majority are clearly defined in the Program of Studies or Curriculum Guide for Elementary School Mathematics (1977). Yet the general objectives outlined in the in the Guide state that instructional programs should foster:

1. A sense of accomplishment and success with mathematics which should lead to a positive self concept, and
2. A positive attitude towards mathematics. (p.7)

At no time in the curriculum development plan was research conducted on the possibilities for student mastery. There is to date, no certainty as to whether or not students do, or in fact will, master the concepts, skills or understandings as specified in the mathematics objectives. Placement of, and adjustments or modification to, grade level content were made more on the basis of teacher and ad hoc committee perceptions. These were perceptions of how well students might perform. Mastery levels were not specified for pilot teachers so that comments received by Ad Hoc members reflected varying interpretations of how well students would perform. In fact many of the statements from pilot teachers regarding the possible achievement status of children were contradictory and so not useful in decision making relative to placement of content objectives. The following comment in the Conceptual Design section of the Curriculum Guide Elementary School Mathematics (1977) also alludes to the lack of surety with regard to the mastery of concepts as currently placed in the program.

> The extent and method of development of each topic will remain the decision of the individual teacher, taking into consideration the abilities and background of each child. As a core program the objectives outlined are those which would normally be covered in a six-year period. However flexibility with respect to applying program objectives to individuals is important. (p.9)

B. STATEMENT OF THE PROBLEM

The problems upon which this study will focus are outlined below:

1. To what extent are students in grades one to six demonstrating achievement of the mathematics objectives which are outlined for their respective grade levels?
2. Will there be any significant change in the number of students achieving to the 85% level between the 1978 and 1979 testing of objectives in each of the Number, Operations and Properties, Measurement, Geometry, and Graphing strands, in Grades one to six?
3. What do teachers attribute low achievement scores of Zone One students to?
    a. A lack of good materials for teaching certain objectives?
    b. Textbooks do not match the program objectives?
    c. The program objectives for certain grade level are too difficult?
    d. The test items are too difficult?
    e. The varied abilities of students makes instruction difficult?

f. The sequencing of content in textbooks is inappropriate?

g. Keeping track of failures and success and subseqent follow-up is too difficult?

4. Will age of entrance to school, sex, geographic location or membership in public or separate school affect the number of students achieving to the 85% level in each objective of the five strands and at each grade level?

5. Can computerized print-outs of individual students school and system results be utilized effectively for diagnostic and management purposes?

C. HYPOTHESIS

The hypotheses which follow are based on some the above problems.

Hypothesis One

Eighty percent of the students in Zone One will not achieve to a criterion score of 85 percent or better in 1978 and 1979 on each of the objectives in the Number, Operations and Properties, Measurement, Geometry, and Graphing strands in grades one to six.

Hypothesis Two

There will be no significant difference in the percentage of students achieving within the 85 percent or higher category (D) between 1978 and 1979 on each of the objectives in the five strands in grades one through six.

Hypothesis Three

There will be no significant differences in mathematics achievement between the early and late starters in mathematics achievement in each of the objectives in the Number, Operations and Properties, Measurement, Geometry, and Graphing strands in grades one through six.

Hypothesis Four

There will be no significant differences in mathematics achievement between boys and girls in 1978 and 1979 on each of the Number, Operations and Properties, Measurement, Geometry, and Graphing strands in grades one through six.

Hypothesis Five

There will be no significant difference in mathematics achievement between North and South Zone students in 1978 and 1979 on each of the five strands in grades one through six.

Hypothesis Six

There will be no significant differences in mathematics achievement between Public and Separate school students in 1978 and 1979 on each of the five strands in grades one through six.

D. DEFINITION OF TERMS

Criterion-Referenced Measures

Criterion referenced measures are those test measurement scores which are used to determine individual pupil status with respect to each mathematics objective in the Alberta Elementary Mathematics Program. The individual student is compared with the established criteria related to the specific program objectives rather than with other students, or groups of students.

Criterion Scores

Criterion scores in this study refer to the achievement levels that collective groupings attain in order to be classified as being within one of the four achievement categories. (eg. Category D; 85 - 100)

Achievement Categories

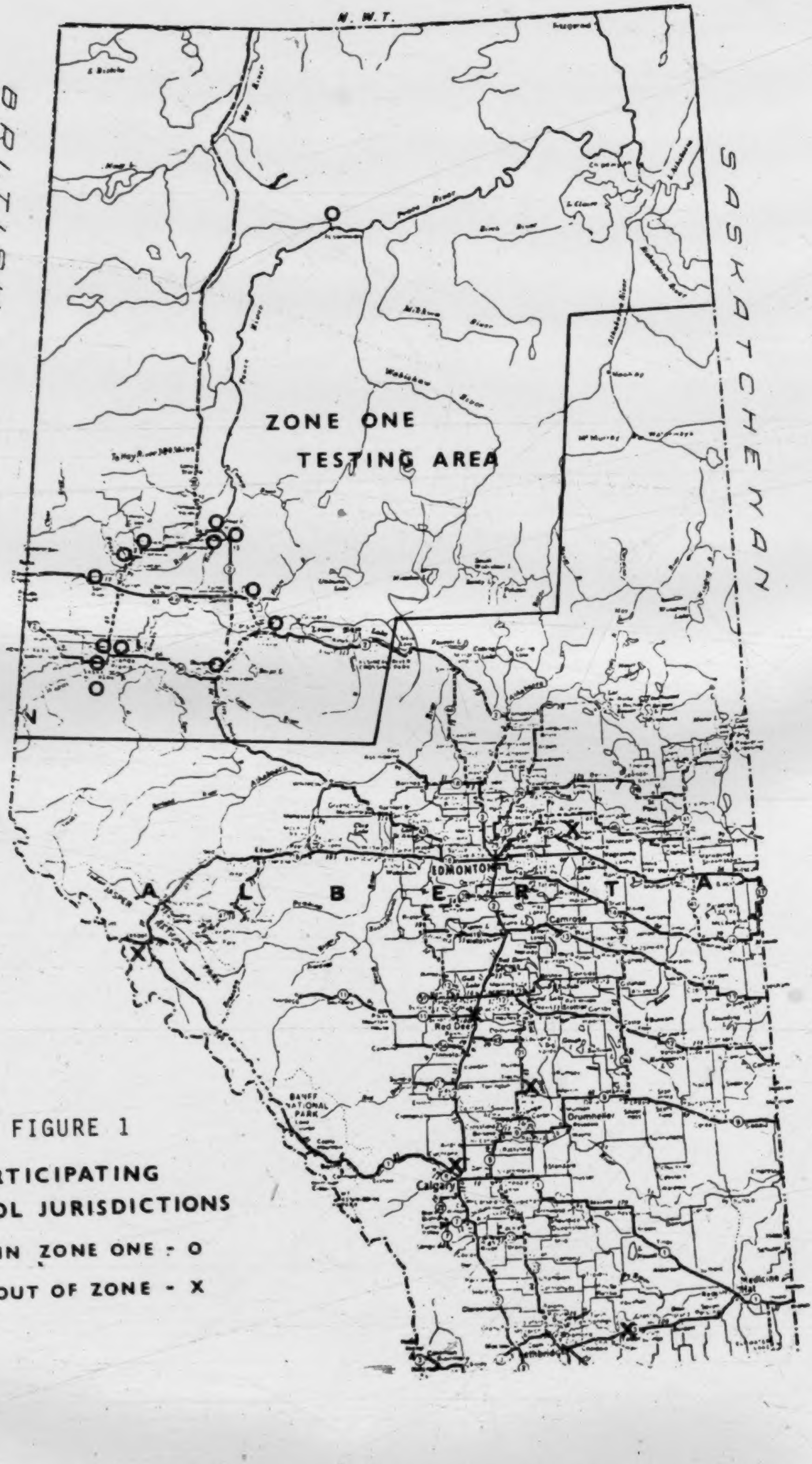
The population of students within each grade will be grouped into one of four achievement categories on the basis of their mean score attainment on each objective. The four specific categories are as follows. Category A: Below 50%; Category B: 50%-64%; Category C: 65-84%; Category D: Above 85%.

Early Starters

Early starters are those students who have entered Grade One younger than 6.0 years of age as of September 5. One year was added for each subsequent grade so as to designate the early starters in grades two through six.

Late Starters

Late starters are those students who have entered grade one older than 6.0 years of age as of September 5. One year was added for each subsequent grade so as to designate the late starters in grades two through six.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SASKATCHEWAN
ZONE ONE
TESTING AREA
Peace River
A L B E R T A
EDMONTON
Camrose
Red Deer
Drumheller
BANFF NATIONAL PARK
Calgary
Medicine Hat
Lethbridge

FIGURE 1

PARTICIPATING SCHOOL JURISDICTIONS

IN ZONE ONE - O

OUT OF ZONE - X

Zone One

Zone One of the Province of Alberta is that area designed as the northern region and within the boundaries as outlined in Figure 1.

North Zone One

Schools north of and including Peace River School Division were designated as North Zone One. These include parts of Northland, North Peace Separate and Fort Vermilion School Divisions.

South Zone One

All schools south of the Peace River School District and in Zone One are considered as South Zone One participants. The systems in this area include Fairview, Spirit River, South Peace Catholic Authorities, High Prairie, East Smoky, and the Grande Prairie School jurisdictions.

Public School Students

These students attend non-sectarian schools which are operated by publicly designated boards.

Separate School Students

Separate School students attend schools which are operated by boards designated as Roman Catholic by faith.

E. SIGNIFICANCE OF THE STUDY

As with most new Programs of Study the progress toward full implementation appears to move slowly. There are perhaps many conditions which tend to impede successful implementation plans. This study centers primarily on one of the contributing factors; the difficulty of content objectives.

The intent of this investigation is to examine student achievement in terms of each of the mathematics objectives in grades one to six of zone one schools. If certain of the mathematics objectives within the scope and sequence of the current program appear to be misplaced, they should be identified for the sake of both students and teachers.

The study will also examine the teacher's interpretation of the difficulties which students are experiencing. This combination of both teacher and student information may provide the basis for any corrective action that appears necessary for the eventual implementation of the elementary mathematics objectives in the Program of Studies for Elementary Schools (1978).

F. LIMITATIONS OF THE STUDY

The interpretation of student achievement within each objective of the Number, Operations and Properties, Measurement, Geometry, and Graphing strands in this study rests completely on the test items that have been referenced to the program objectives. Although these items were validated to measure the specific objectives, the vocabulary and form of particular test items may be biased towards the particular stances of textbooks or the instructional designs of teachers. No attempts were made to counteract or complement the instructional approaches used in the textbooks nor to check for the instructional preferences of teachers in their handling of the mathematics concepts.

There are other factors which could have an effect on pupil achievement and which were not considered in this study. For example, the amount of time which schools devote to mathematics and the variance in pupil attendance may account for some of the achievement differences. Neither was the effect of teaching on achievement taken into account.

Also, this study does not claim to evaluate the total scope of mathematics learning. As Suydam (1978) says "evaluation in the mathematics classroom consists of much more than a testing program involving pencil and paper" (p.3). The measurement of computational skills and specific mathematical processes is but one aspect. Other goals such as those related to the student's behavior towards mathematics are equally important. Thus a major weakness of this study would be that it is concerned primarily with the cognitive aspects and not with the affective factors of student performance.

Finally, although it is somewhat limiting to focus on one aspect of evaluation there may be no other way. As Hersom (1974) suggests, if one is to concentrate on pupil assessment then the curriculum development and implementation factors should not be evaluated within the same context. They are the accepted givens. This study does focus on pupil assessment, although there are attempts to implicate the processes of curriculum development and implementation.

CHAPTER II

REVIEW OF RELATED LITERATURE

A study such as this which deals with testing for assessment, diagnostic and evaluation purposes necessarily involves many topics which are related to the subject area in question. The literature review which follows will consider some of these topics, most of which fall within the historical, psychological and sociological aspect of teaching and learning in mathematics. Of particular relevance to this study are the present concerns for assessing students for 'basic' competencies. This is reflected in the mandates given to the Minister's Advisory Committee on Student Achievement (MACOSA).

A. BACKGROUND

In recent years there has been an increasing amount of criticism of the mathematics curriculum that reflects both school and public disillusionment with the mathematics that each has come to know. The gist of public criticism, according to Rappaport (1977) is that "children are unable to solve problems of everyday life"(p.7). Such concerns have led to such cries as 'back to the basics' and 'test for minimum competency'. Gilman (1978) says that until two years ago the latter, minimum competency testing, was unheard of, yet by September of 1977, eighty percent of the American student population were confronted with writing an examination intended to demonstrate skills 'suitable' for receiving a Diploma.

Schools still disappointed with the 'new mathematics' were understandably skeptical with the latest introductions which talked about such things as objective based content, minimum skills and success centered learning.

In order to better understand or relate to these criticisms perhaps it is necessary to examine a few points from the history of mathematics education. Clear cut dates are unrealistic, however some educators (Trafton, 1975; Rappaport, 1977) have observed three distinct mathematics eras within the twentieth century in which the basic goals of mathematics learning have differed. Rappaport (1977) describes the first period, 1900 - 1935, as the "Era of Traditional Mathematics". The main emphasis during this time was to teach children the skills that would enable them to solve problems in everyday life. The subject labelled arithmetic was thought of as a 'tool subject'. Skill and accuracy were the main goals.

Trafton (1975), discussing the setting for reform in the 1930's, says that the arithmetic programs were beginning to face intense scrutiny. The second period, from 1935 to 1958, grew out of this examination and became known as 'The Meaningful Arithmetic Era'. "The new emphasis was on the why as well as the how" (Rappaport, 1977, p.7). This era was to have students understand the arithmetic concepts and processes underlying the computational skills. The solving of problems was also emphasized and the content of the program according to Rappaport (1977) was "the same as during the times of Traditional Mathematics; the change was in the psychology of teaching and learning rather than in the content" (p.7).

The third period, 1958 to the present, has been labelled as the "New Math Era"(Rappaport, 1977,p.7). This era was characterized by a change from the top down; from developments in mathematics at the post secondary level to resultant changes in the high school, to the junior high, and in a relatively short time mathematics programs for grades one to twelve. This 'new' mathematics placed emphasis on sets, set operations and a knowledge of number systems. "There was a demand for greater rigor in definitions so that the logical structure of a number system could be understood and applied to the development of other number systems" (Rappaport, 1977, p.8). Although there has been some real criticism of the programs of this era there is little evidence of these programs having any impact on schools. One study revealed that although signs of a changing curriculum appeared in textual material, no dramatic upheaval actually occurred. Their research concluded that in "elementary schools, established time and teacher priorities remain with the historical areas of computation with whole numbers, concepts of number operations, fractions, problem solving and application, measurement with a bare reflection of geometry" (Lenchucha, 1978; p.3)

Presently there is some evidence to suggest that we are in a new era or perhaps one that is a make-up from those of the past - The basics of mathematics. To date however there appears to be little agreement as to what constitutes the basics. Educators themselves disagree, not only between but within subject areas.

Basics can be defined very broadly to include such personal aspects as needs for self esteem, worthwhile experiences and significant others who are to be make sense out of the conglomerate of student experience.

For mathematics, some view basics as involving primarily the four operations of addition, subtraction, multiplication and division. Others would include the developmental aspect of numbers such as being able to classify and order objects of various size, shape or consistency.

The National Council of Supervisors of Mathematics Position Paper on Basic Mathematics Skills lists ten skill areas that they say students will need in order to function properly in today's society: (1) Problem Solving, (2) Applying mathematics in everyday situations, (3) Alertness to reasonableness of results, (4) Estimation and approximation, (5) Appropriate computational skills, (6) Geometry, (7) Measurement, (8) Reading, interpreting, and constructing tables, charts and graphs, (9) Using mathematics to predict and (10) Computer literacy (Smith, 1978, p.25).

Smith (1978) makes seven recommendations that are directed to those considering the establishment of a minimum competency (M.C.) program in mathematics.

1. Establish M.C. objectives that address a wide range of mathematics concepts, skills, and generalizations.
2. Establish appropriate M.C. that serves as checkpoints at various grade levels.
3. Be certain the mathematics curriculum is designed to help students achieve the minimum competencies. We must not, however allow M.C. attainment to cause curriculum to regress to the pre-fifties level.
4. Include individual performance tests as well as group administered tests in the student assessment program.
5. Clarify the role of hand calculators in the educational process.
6. Be prepared to implement remediation programs for those students who fail to demonstrate certain competencies. This preparedness includes a financial commitment.
7. Integrate topics in consumer mathematics throughout the K - 12 curriculum - even for the mathematically talented (p. 26).

Chaplin (1978) lists three dangers for aiming instruction at the 'minimums'. First he says there is a danger of teaching isolated skills rather than conceptual wholes. Secondly, teaching towards minimum standards results in the practice of teaching towards the test rather than for growth. Thirdly, he says that thinking minimums "leads to emphasis on actuality rather than possibility" (p.25).

Macdonald (1972) adds another perspective in his address to competency based teaching:

> This behavioral approach is primarily in tune with a general technological rationale that exists in our society, and it is now being applied to human engineering problems. The people who are interested in this approach are primarily interested in control. They wish to control the behavior of others for the achievement of goals they believe in. This is a mechanism, a potentially powerful technique, and I have a number of reservations and objections to this approach (p.2).

There are other aspects of today's society besides the concerns for basics and minimum competencies that have relevance for the evaluative nature of this study.

B. A CHANGING SOCIETY

Tyler in his introduction to the Crucial Issues in Testing (Hunt and Randhawa, 1976) points out that major shifts in today's labor force are in essence responsible for a changing emphasis in education. Fewer people are actually engaged in producing and distributing material goods while more than sixty percent are involved in furnishing non-material products such as health, education, recreation and administrative services. This has led Tyler (1976) to say of schooling: "The critical task is no longer to sort students but rather, to educate a much larger proportion of students to meet current opportunities" (p.3). He suggests that this reemphasis in schooling has in part caused changes in evaluation ideas. For example, failure to learn is now regarded not so much as a problem of native limitations of the student but more the result of inefficient learning strategies (Hunt, 1978).

Tyler suggests that we not only be concerned with the 'what?' but the 'why?' of evaluating students. He recommends that evaluation systems concentrate more on the information that leads to program effectiveness and less on the test scores that compare pupils. Figure 2 illustrates many of the possible responses to the "why" of evaluation.

The specifying of appropriate mathematics aims, goals and objectives is one purpose for evaluating.

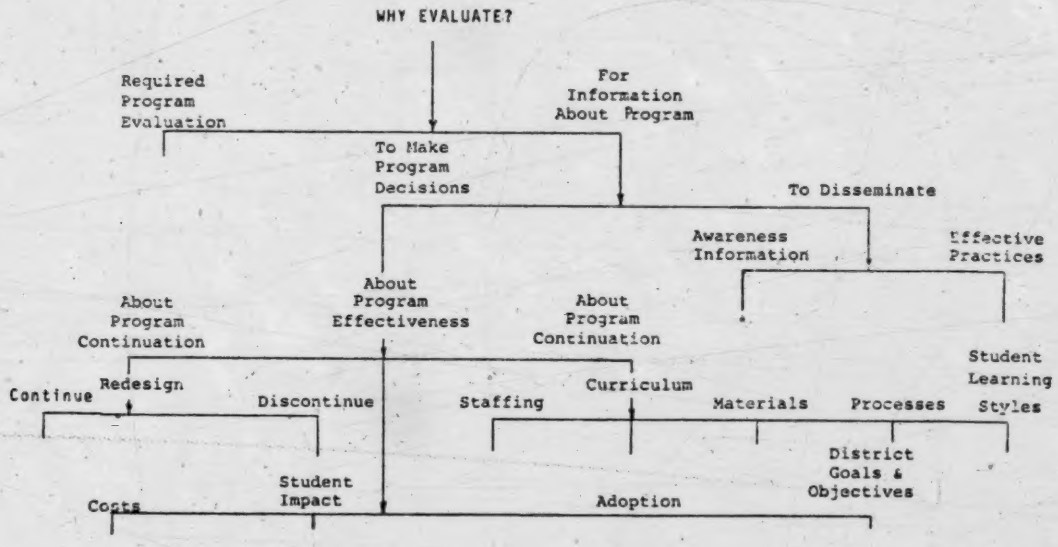

WHY EVALUATE?
Required Program Evaluation
For Information About Program
To Make Program Decisions
To Disseminate
Awareness Information
Effective Practices
About Program Effectiveness
About Program Continuation
About Program Continuation
Student Learning Styles
Continue
Redesign
Discontinue
Staffing
Curriculum
Materials
Processes
District Goals & Objectives
Costs
Student Impact
Adoption

FIGURE 2

A CHART FROM "WHY EVALUATE? ...
THE EVALUATORS DILEMMA"- Hunt(1978)

C. AIMS, GOALS AND OBJECTIVES

One of the necessary steps in the development of any educational program is that it be founded upon agreed to aims, goals and objectives.

Robert Zais (1976) makes an often overlooked distinction between the terms aims, goals and objectives. He says that "curriculum aims are statements that describe expected life outcomes based on some valued scheme either consciously or unconsciously borrowed from philosophy" (p. 306). The distinct quality of aims is that they, in contrast to curriculum goals and objectives, do not relate directly to school or classroom objectives (e.g. self realization). The Elementary Mathematics Guide substitutes the word goals for aims.

Curriculum goals most often vary as to their degree of specificity, "but in general will tend to be long range and somewhat removed from the immediate classroom"(Zais, 1976, p. 306). (e.g. to develop an appreciation of mathematics.) The Alberta Program uses the term General Objectives in place of goals.

Curriculum objectives are most often defined in terms of the most immediate specific outcomes of classroom instruction. The concepts, skills and understandings outlined for each of the elementary grades are in objective form.

Zahorik (1976) outlines six dimensions of objectives which have implications for this study. The dimension of (1) substance concerns the specific categories of learning to be acquired. One set of categories is content, process and values. Content itself consists of facts, generalizations and concepts; process consists of the academic skills and abilities as well as personal-social skills and abilities. Values consist of feelings, emotions and appreciations. The second dimension is that of (2) level which focuses on the complexity of the behavior called for in the objective. Low level objectives call for relatively simple behavior such as that required in demonstrating mastery of the basic facts. Higher level objectives call for such actions as problem solving behavior. Another dimension is that of (3) focus. This aspect deals with the breadth of an objective. An objective can have a narrow focus such as on an independent skill or it may be a dependent or hierarchical concept. The dimension of (4) form refers to how the objective is stated. Three forms which Zahorik (1976) lists are behavioral, conceptual and topical. Conceptual objectives are stated as concepts or generalizations and relate to content, process or value. A topical objective outlines a specific subject matter topic such as "Reads and writes decimals to tenths." The behavioral objective involves all six dimensions so follows a description of the time dimension. Another dimension is (5) the target. It is concerned with whom the objective was designed for. The objectives of the elementary mathematics program for example have grade level as target.

The final dimension is (6) time. Here the question is when the objective is to be achieved, after an instructional session or by the end of the school term.

A behavioral objective according to Zahorik (1976) "Involves a narrow focus, a pupil as target, and an immediate time period, exploring any type of substance at any level of complexity" (p. 10). In contrast a general objective he says, while dealing with any kind of substance or any level, has a broad focus, a remote time period, either the pupil or the teacher as the target, and is of topical form.

Bell (1976) outlines a typical set of mathematics goals which are intended to reflect not only interest in the attitudes, skills and understanding of students but in processes of learning and the needs of society.

> 1. The mathematical learning process comprises content learning
>   - the learning of concepts and relationships
>   - the learning of facts and skills, and process learning
>   - the learning of general mathematical strategies (e.g. problem solving, ...)
>   - the development of critical and creative powers in a mathematical context.
>   - the development of a general appreciation of the nature of mathematics and of its applications in the world and of positive attitudes towards it. (p. 3)

Beggs (1973) speaks of educative learning as involving subject matter or content learned, the process used by the learner as a result of his learning activities and the goal of transfer. He says that the content is a means not an end, in fact, "the intent in learning is to change the learner so that he is more able to cope effectively and automatically with novel situations" (p. 3).

Some cautions have been expressed for placing too much emphasis on the objective statements in mathematics programs. Zahorik (1976) suggests that the nature of objective statements is such that all aspects of learning should be predictable. This, he says, "is not always possible" (p. 9). Also some areas such as affective learning while considered important cannot easily be placed in objective terms. He suggests further that "behavioral objectives overemphasize simple learning and evaluation" (p. 9). Eisner (1977) says that "one symbol system cannot provide the richness of view that we need. The assumption to provide an unbiased objective description of what children learn and what teachers teach by measuring which objectives have been reached may lead us to accent the part for the whole" (p. 621). "In Education", he says, "we need to catch many fish but we have used nets that let many of the most interesting ones get away" (p. 621).

The Recommendation and Perspectives for School Mathematics from the National Advisory Committee on Mathematical Education (NACOME) contains perhaps the most comprehensive suggestions for those associated with mathematics education. Five of their recommendations are applicable to this study and are summarized as follows:

> Recommendation 1 Anti-Dichotomy
>
> In the creation, introduction and support of mathematics programs, neither teachers, educational

administration, parents, nor the general public should allow themselves to be manipulated into false choices between the old and the new mathematics, skills and concepts, the concrete and the abstact, intuition and formalism, structure and problem solving, and induction and deduction. The core of every mathematics program should contain a judicious combination of both elements of each pair with the balance, proportion and emphasis between them being determined by the goal of the program and the nature, capabilities and circumstances of the students and teachers.

Recommendation 2 Quality Education

Every child is entitled to the mathematical competencies necessary for daily living, but the content and essential "basic skills" must be defined to include computational skill as well as ability to deal intellectually with statistical information, to reason logically, and think critically. Minimum skills cannot be allowed to become ceilings of performance for any youngster. Provision and support of equality backers is primary to the accomplishment of these goals. Teachers of mathematics should continue to be supported within their school system by qualified resource specialists in mathematics curriculum and instruction.

Recommendation 3 Curriculum Content

Curriculum content cannot be viewed as a fixed set of goals or ideas; with this in mind, no definitive curriculum can ever be recommended. But as reasonable and essential features of a contemporary mathematics curriculum it is recommended that:
Logical structure should be maintained as a framework for the study of mathematics.
Concrete experiences should be an integral part of the acquisition of abstract ideas.
The opportunity should be provided for students to apply mathematics in as wide a realm as possible - in social and natural sciences, consumer and career - related areas and real life problems.

Recommendation 5 The Affective Domain

Positive attitudes and expressions on the part of parent, teachers and the general public with regards to mathematics are fundamental. The affective as well as the cognitive domains in mathematics should be the subject of constant programatic action; basic research into the affective domain be specifically vis-a-vis mathematics should be pressed, and;

> attempts to create more appropriate and sensitive instruments for assessing the affective domain should be mounted.
>
> ### Recommendation 6 Evaluation
>
> NACOME recommends that all evaluation instruments be selected after program or individual goals are identified and that they be matched to these goals; that grade-level score reporting on standardized tests be made to develop objective directed tests to replace the norm - referenced tests now commonly used (pp. 16-19).

The final recommendation concerns the primary objective of this study; evaluation and testing.

In her publication *Evaluation in the Mathematics Classroom* Suydam (1974) stresses the importance of knowing the directions of programs and the use of evaluation activities to determine whether or not these directions are being followed.

> In the study of mathematics a student must learn facts, develop concepts, use symbols, and master processes and procedures. But he should also learn to develop generalizations and to sense the presence of mathematical ideas and structure not only in the abstract situations but also in many areas of human activity. He should develop his reasoning powers in order to prove or disprove a statement by deduction or to predict an event with appropriate probability. It is the function of evaluation to determine how well a student has mastered these varied aspects of mathematics (p. 5)

D. EVALUATION AND TESTING

Dyer (1967) says that an educational instructional goal can be defined "only in terms of the agreed upon procedures and instruments by which the attainment is to be measured" (p. 129). These procedures refer to the utilization of various forms of testing, measurement, assessment and evaluation systems. Figure 3 is included to illustrate how one may distinguish between these terms.

Tyler (1974) suggests that the changed emphasis on providing meaningful learning programs for students has been, in part, responsible for such instructional models as Mastery Learning, Individualized Instruction and Performance Contracting. Accordingly, he says, we find a changing emphasis on student evaluation.

For example, the evaluative aspect of an instructional strategy such as mastery learning holds to the idea that most students can be brought to certain criterion levels of performance in specified subject areas. This particular emphasis in turn carries with it a need for new strategies in educational evaluation. A comparison of norm-referenced and criterion-referenced testing will illustrate this point.

Norm-referenced evaluation is used to ascertain a student performance against the performance of other students on the same measuring instrument. It is obvious that norm referenced scores have meaning only as they compare with the scores of other individuals who took the same test. Hunt (1976) suggests that the average level of

	MEASUREMENT	ASSESSMENT	EVALUATION
Purposes and uses of tests	Prediction	**Prediction**	**Prediction**
	Certification	Classification (certification)	Certification
	Experimentation (control of effects of testing)	Experimentation	Experimentation
	Normative and Criterion based tests.	Emphasis on effects of measurement/effective functioning under testing conditions.	Utilization of effects of testing, operational definition of objectives, motivation of students, motivations of instructors.
	Summative and/or formative judgments.	Diagnosis and prognosis with respect to criterion situation.	Summative judgments.
	May be used as one source of information by either assessors or evaluations	Attempts to define syndrome and determine underlying causation. Most frequently used in formative efforts.	Diagnosis with respect to attainment of objectives as they relate to educational and/or social values.
Educational Implications	External pressures and may result in some changes.	Revision coincident with the observation of relations between diagnosis, prognosis and performance.	Revision coincident with the relationship between overall performance and aims, and relevance to values, which may vary with clients.
	Implies what a teacher does is relatively static.	Attempts to assess what a teacher and student does in a life situation.	Attempts to determine the amount of educational change effected.
	Formal techniques geared to curriculum content, subject matter, texts, lectures, etc.	Any type of educational experience relevant to performance in a criterion situation.	Any type of educational experience that will foster achievement of objectives.
	Surveys conducted by an external agency.	Appraisal directed by assessors.	Evaluation directed by evaluators.
	Comparisons of schools over space and time.	Feedback to learner and teacher.	Effectiveness in terms of implicit or explicit objectives.
Emphasis in Testing	Quantitative description of individual with respect to normative population.	Qualitative description with respect to effective functioning or to overall functioning. (N.B. Quantitative measurement sometimes used in order to get at qualtitative e.g., temperature)	Quantitative and qualitative description with respect to implicit or explicitly stated values either education or social - objectives, goals, aims.
	Assumption of a stable world and stable characteristics of individuals.	Present equilibrium of trends and behavioral tendencies inferred from dynamic analysis.	Constantly changing world. changing characteristics of individual.
	A single sampling of behavior of one aspect of behavior.	Many aspects of behavior assessed over a period of time.	Several aspects of behavior examined at one time.
	Development of standard instruments.	Development of instruments for specific situations through a variety including standardized instruments.	Development of specific instruments or use of standardized tests if they match the behav ior objective.
	Ojectivity and reliability (validity secondary).	Validity (objectivity and reliability secondary).	Validity (objectivity and reliability secondary).
Data-gathering Techniques	Usually paper and pencil or any method which yield objective evidence.	Any device which will yield relevant evidence.	Any device which will yield relevent evidence.
Scoring and Interpretation of Test Results	Objective.	Subjective with lesser degree objectivity.	Objective and subjective.
	Accuracy and/or speed of response - single sampling.	Process of responses, total responses.	Pattern of responses and all relevant responses.
	Addition or summative combination of scores.	Attempts to assess process.	Pattern and relating of evidence between scores and process.
	Interpretation in relation to group norms, either of an individual or a group.	Interpretation in relation to functional hypotheses	Interpretation in relationship to objectives.

FIGURE 3

CHARACTERISTICS OF MEASUREMENT

ASSESSMENT, AND EVALUATION - Jenkinson (1979) performance of the group becomes the reference point about which the measurement scale is anchored. The comparative scale becomes a function of the distribution above and below the average. Ebel (1971) adds that measurement systems have taken this route "since the model adopted in psychology was the individual difference model which implies comparisons among individuals" (p. 17). An assumption in norm referenced testing (NRT) accordingly is that individuals differ and the results should be a reflection of these differences. Hunt (1976) adds two additional assumptions about NRT. One is that "high marks must never occur on test results and the second is that some failures must always occur" (p. 7).

Most evaluative systems up to the early 1960's appeared to concentrate on the comparison aspect until Glasser (1963) introduced the term criterion-referenced testing (CRT) somewhat in opposition to norm referenced forms. Glasser and Nitko (1970) defined a criterion-referenced test as "one that has been deliberately constructed so as to yield measurements that are directly interpretable in terms of specified performance standards" (p. 630). In this system the performance of a student is now determined by his own skills and is not dependent upon the performance of his peers.

Hambleton (1978) reports that today criterion - referenced tests are used to monitor individual progress in objective based instructional programs, to diagnose learning difficulties, to evaluate educational and social action programs, and to assess competencies in various technical and certification programs. He also points out that until quite recently (Glasser and Nitko, 1971; Harris, Alkin and Popham, 1974), there have been few reliable guidelines for test construction, test assessment and test score interpretation and that this in turn has hampered the effective use of criterion-referenced tests. Confusion also exists over the use of the terms according to Hambleton (1978). "There are more than 600 references on the topic of criterion-referenced testing, unfortunately, it seems that there are almost as many ideas about what a criterion referenced test is as there are contributors in the field" (p. 2).

One of the major sources of confusion appears to be over the word criterion. For many it refers to a performance standard, a minimum proficiency level, or a cut-off score. However (Hambleton, 1978; Popham, 1975) seem to indicate "that the use of the word criterion should refer to a domain of behaviors" (Hambleton, 1978, p. 2). Hambleton (1978) in fact accepts the definition of the criterion-referenced test stated by Popham (1975). "A criterion-referenced test is used to ascertain an individual's status (referred to as a domain score) with respect to a well defined behavior domain" (p. 2).

There appears to be further confusion over the differences among three somewhat related tests -- criterion-referenced tests, domain-referenced tests, and objective referenced tests. If one were to accept Popham's definition there appears to be no difference between the criterion referenced tests and domain-referenced tests. Objective-referenced tests and criterion-referenced tests differ in the following way according to Hambleton (1978). On a criterion- referenced test, the items are a representative set of items from a clearly defined domain of behaviors measuring an objective.

With the objective referenced test no domain of behaviors is specified, and items are not considered to be representative of any behavior domain.

The emphasis on testing lately seems to be on the criterion referenced type. Gronlund (1973) in his book _Preparing Criterion Referenced Tests_ comments on how, besides improving instructional decisions, such tests can aid the learning process by improving student motivation, increase retention, improve transfer of learning, increase student self understanding and promote feedback concerning instructional effect. Gronlund (1977) also outlines five basic principles of achievement testing which are worth noting.

1. Achievement tests should measure clearly definable learning outcomes that are in harmony with instructional objectives.
2. Achievement tests should measure and represent samples of the learning outcomes and subject matter included in the instruction.
3. Achievement tests should include the types of items which are most appropriate for measuring the desired learning outcome.

4. Achievement tests should be designed to fit the particular uses to be made of the results.

5. Achievement tests should be used to improve student learning (p. 7-14).

Popham (1978) lists the following attributes of a well constructed Criterion-Referenced Test:

> (1) An Unambiguous Description Scheme that spells out just what it is that examinees who take the test can or cannot do.
>
> (2) An Adequate Number of Items It is technically impossible to get a decent fix on an examinee's status with respect to a particular skill by using only a handful of items.
>
> (3) Reliability and Validity
>
> (4) Comparative Data Normative data that permit education to answer more sensibly the question: "How good is good enough?" should be available (pp.93-94).

The most significant questions surrounding the issues of testing are perhaps those which are why and how tests are to be used. Educators at all levels, from the classroom to the Department of Education, who are involved in curriculum and instructional decision-making should be concerned about such questions.

Nyberg (1977) requests a new look at testing procedures.

> As achievement testing, propelled by the "back to the basics" movement, returns to the educational scene it is most important that everyone concerned with schooling put forth an effort to share a new structure. We must not think in terms of returning to something that existed in the past, rather we must look to producing a system that fulfills purposes determined on a national basis (p. 18).

He expounds the need for an evaluation system that does not consider measurement as an adjunct to teaching but as an integral part of the educational process. "Without some sort of measurement (I did not say formal test), teaching becomes a matter of hit or miss at best, and sheer chaos at worst" (p. 19). Nyberg (1977) considers testing to be an integral part of curriculum because of its benefit in decision-making; decisions by teachers, counsellors, students and parents. Most Alberta educators are concerned that we not go back to the province-wide Department of Education testing. However, there appears to be a renewed interest for Provincial involvement of some sort. The MACOSA studies and the current involvement in 'Power Testing' is an indication that the department is not reluctant to act in this area.

A testing system that would avoid the old pass-fail stigma and still provide the basis for the monitoring of achievement and decision-making regarding the strengths and weaknesses of pupils appears to be of the most interest. This of course is a big request.

> The overall emphasis of an achievement monitoring program would be to make instruction more effective. At the classroom level, teachers would have early in the school year, information on the strengths and weaknesses of each pupil. At the curriculum decision-making level both local and provincial working committees would have data revealing long-term trends in achievement, and data that could be useful in curriculum research (Nyberg, 1977, p. 21).

Concerning this latter aspect Hersom (1974) writes that

> the praxis of curriculum evaluation is seldom characterized by the linearity and logical sequencing portrayed by theoretical models. One result of this is that the curriculum evaluation component is either ignored entirely or else associated solely with product or outcome questions (p. 100).

Curriculum evaluation practices have, in fact, varied in their approaches towards accounting for curriculum decisions. There are several stances which appear to be open in this regard. One is to abdicate the evaluator's responsibility for making judgements altogether and to emphasize his role as an information provider for decision makers (Shuffleheam, 1971).

Another is to focus on the observable, measurable behaviors of students (Popham, 1973). Still others recognize that "curriculum evaluation is political in nature and that decisions are derived from biased origins which should be taken into account" (Hersom, 1974, p. 101). Greenbaum (1977) says that

> serious consideration must be given to the differences between evaluation which can produce relatively immediate and real improvement versus those that can produce meaningful symbols which might lead to progress only in the future, versus that which have little direct utility or positive symbolic value but which become excuses for existing inadequate conditions"(p.3).

E. MATHEMATICS ASSESSMENTS

Another indication of the current interest in the basics of mathematics learning is reflected in the emphasis given to assessing the competencies of students.

Robitaille (1977) says that the principle that underlies any learning assessment program is that "decisions about education should be based upon knowledge of what and how students are learning "(p. 6). Four major functions of assessments can be drawn from the 1977 British Columbia Assessment report: (1) To assist school districts in maintaining and identifying strengths and weaknesses of programs; (2) to provide curriculum development and revision committees with data for the improvement of curriculum; (3) to provide the basis for the development and allocation of resource material at both the provincial and district levels; and (4) to provide useful information to university level institutions that will indicate directions for change and improvement in teacher education"(Robitaille, 1977,p. 6).

The First National Assessment of Educational Progress in the United States, conducted during the 1972-73 school year, studied the knowledge, skills, understanding and attitudes of four age levels (9, 13, 17 and adults - ages 26-36). A three-dimensional classification scheme was used to categorize the mathematics objectives studied. These dimensions were the Uses of Mathematics , the Content of Mathematics and the the Cognitive Objectives or Abilities dimension (e.g. to recall and/or recognize definitions, facts and symbols). An overview of the results showed the following for nine year olds (Approx. 25% Grade 3, 75% grade 4).

1. The performance on simple numeration tasks such as recognizing place value, counting by tens, or writing numerals was "quite good" for 9-year olds.
2. Acceptable performance was found on exercises measuring knowledge of number properties and operations.
3. Students handled addition problems well, but they did poorly on the other operations.
4. Successful performances were reported on simple problem-solving tasks requiring reading (or listening to) a verbal statement of a problem, selecting a whole number operation and appropriate data from the statement and obtaining the answer by computation.
5. Students showed reasonably good performance on numeration concepts such as recognizing a digit in the tens place of a four digit number, selecting the verbal translation of a three digit number, counting by 10's, selecting a translation from words into symbols and determining odd or even whole numbers.

   Most (85%) of these students could order a sequence of six whole numbers.

   Students had difficulty with the 0 property such as in 3 x 0 = 3.
6. The data for this group (9 year olds) indicate that computational skills have not been mastered.
7. Only a small percentage of the 9 year olds showed knowledge of elementary fraction concepts.
8. Most nine year olds could recognize and name basic plane shapes such as circle, rectangle, and triangle, but few were familiar with the terminology for diameter of a circle, parallel lines or right angle.
   (Results from the First Mathematics Assessment, NCTM, 1978, pp. 14-89)

The British Columbia Mathematics Assessment (Robitaille, 1977) tested over one hundred thousand students from Grades 4, 8 and 12 on their degree of mastery of "a limited number of important mathematical skills and concepts"(p. 8). Although students were evaluated at the three levels indicated, results were to coincide with the end of primary education (Grade 3), end of elementary (Grade 7) and end of public schooling (Grade 12). Test results were judged by Interpretation Panels consisting of educators, school trustees and members of the general public. The mathematics assessment items numbering sixty nine were geared to measuring student mastery of ten objectives in three domains; Computation and Knowledge, Comprehension, and Applications of mathematics.

Satisfactory performances by grade 4 students were exhibited in the following areas: ability to add, subtract, multiply and divide, knowledge of symbols and terminology, geometric concepts and problem solving. Less than completely satisfactory performances were found in subtraction of whole numbers involving regrouping. Poor achievement ratings were found for student comprehension of fraction concepts and the metric system of measurement. Older students outperformed the younger, female students did better than males in computation while males outperformed females in problem solving.

The Edmonton Grade III Achievement Study: 1956-1977 Comparisons (Reading and Mathematics) was commissioned in the spring of 1977 over "public concern about standards of school achievement" (Alberta Education Report, 1977, p. i). This study involved all the Grade III students in the Edmonton Public School system. Thirty five hundred students were tested in May of 1956 and the same instruments reprinted for the May of 1977 re-testing (4500 students). Because of the twenty-one year time difference, various educators were asked to examine each test item to determine its appropriateness for the 1977 student. A total of 12 arithmetic items were identified as not appropriate, and as such were eliminated from the instrument. The original California Achievement Tests of Arithmetic from 1956 were re-scored so as to be comparable to the 1977 results.

This study reported that the average score made by the Grade III students in 1956 was 55.98. The corresponding score made by Grade III students in 1977 was 55.56. This difference of 0.42 represents a one percent decrease in performance from 1956 to 1977, not a significant difference. Indeed the researchers for the Grade III study suggest that the change in curriculum emphasis during this time would more than account for this variance.

The Minister's Advisory Committee on Student Achievement (MACOSA) for Alberta was established in November of 1976 to study the problems related to student achievement in Alberta and make recommendations for their solution. The Alberta Assessment of School Mathematics , was one study assigned by this group. The results (Olson, Sawada and Sigurdson, 1979) like the B.C. Assessment data, were filtered through an Interpretation Panel.

A technique known as Matrix sampling was used in this study whereby both students and text items are sampled. The design is such that not all students wrote all of the items in a given test battery but rather a grouping of approximately twenty items each. Students also were tested on three types of items. Preview items were those which were given at a division lower than where they would normally be taught. They "provided preview information on that content" (Olson, et al, 1979, p. 3). Target items were those which covered material that would normally be taught at a division and thus were given at that particular division. These items were to provide information on how well students were performing at mathematical concepts and skills specified for their level by the Alberta Program of Studies. The third type of items were the Review type. Items of this class were given at a division higher than target with the intent that information on how well students performed on material they should have mastered at least three years earlier should be available. The MACOSA report outlines findings in five main areas that concern the elementary grades specifically.

Number

At the Division I level strong performances were obtained on the fundamental skills of primary school mathematics - percentage scores ranging between 91 and 98 were given on items dealing with cardinal number of a set, reading 3-digit numbers, counting by tens, ordering 4-digit numbers, and the basic facts of addition and subtraction. Rather weak performances were obtained on exercises dealing with rational numbers ... performances ranged between 11% and 72%. At the low end were simple decimal tasks that 0.3 be read as three tenths, and at the high end were tasks dealing with recognizing common fractions.
At Division II the strong start made on the fundamental skills continued with performance in the 90's given on exercises dealing with basic facts of multiplication and division, adding and subtracting and multiplying multi-digit numbers, reading 5-digit numbers, and rounding to the nearest tenth. As with Division I, the work with rational numbers was weak both in common fraction form or decimal form. Performances with integers were low.

Algebra (The Operations and Properties)

In Division I over 80% of the students showed an understanding of the use of the box " " in a simple algebraic sentence while two-thirds of them could translate an English statement into a sentence containing a box. One third of the students understood the concept "more than" and the accompanying symbolism ">". By Division II, two-thirds of the students were using this idea of inequality correctly. The focus of Division II algebra was verbal problems. Simple problems containing 3 or 4 sentences and one or two operations were answered correctly by less than 75% of the students.

Geometry

Students appeared to do well on topics in geometry that receive emphasis in schools. Performance levels for example were relatively high on the following topics: angles, triangles, circles and congruence. In contrast, the following topics were not handled nearly as well: similarity, line relationships (parallelism and perpendicularity), and polygons. Other weak areas, probably because of a lack of exposure, were transformations and symmetry.

Measurement

The telling of time, figuring with money, and measuring

length had strong beginnings in Division I and rose to 90% performances.
Division II. Questions on perimeters, area, and volume fared less well. Performances dealing with the interrelationships among length, area and volume were particularly low (30% - 40%).

Statistics (Graphing)

Division I scored high on picture graphs and about 40% on line graphs with only one-third able to construct a bar graph.
Division II did well on the bar graph and line graph and 50% on the circle graph.

One of the difficulties in the Alberta Assessment of School Mathematics centers on the terms used to describe acceptable levels of achievement. A satisfactory achievement score for one grade level often became unacceptable for students at another grade even though the interpretation panel and researcher ratings with regards to what constitutes satisfactory or unsatisfactory performance did not agree consistently. This will make meaningful reporting and follow up a difficult task.

F. REGIONAL DIFFERENCES

Burger (1974) examined the relationship between geographical isolation of a school and pupil alienation in the Northland School Division which is included in Zone One in the current study. He used Seeman's (1959) five dimensions of alienation which were:

Powerlessness - "The expectancy or probability held by the individual that his own behavior cannot determine the occurrence of the outcomes or reinforcements he seeks."

Normlessness - "A high expectancy that socially unapproved behaviors are required to achieve given goals."

Meaninglessness - "A low expectancy that satisfactory predictions about future outcome of behavior can be made."

Self-estrangement - "The degree of dependence of the given behavior upon anticipated future rewards."

Isolation - Assigning low reward value to goals or beliefs that are typically highly valued in the given society (p. 784-791). Burger (1974) reported t-tests between students in geographically isolated and non-isolated schools that were related to total alienation and the normlessness dimension at the 0.5 level of significance and to the powerlessness dimension at the .001 level of significance. No significant relationship was found between location of the school and the self-estrangement and meaninglessness dimensions of alienation. Burger (1974) contends that the "alienation of students in Northern Alberta is magnified by cultural differences between white teachers and native students, and that little interrelationship exists between the student's school life and community life" (p. 1). Lane's (1967) statement adds support to this position:

> ... traditional Indian ideas about how learning takes place, what sorts of things are important, at what ages should children learn certain kinds of things, in what way and at what speed, differ significantly from the educational philosophy underlying the federal and provincial school system. (p. 33).

Dumont (1971) studying school withdrawals in the High Prairie School Division concluded that "certain factors which can be identified early in a student's career can be used with a certain degree of confidence to distinguish the potential early school leaver from the potential graduate"

(p. iii). A study group of 97 boys and 84 girls who had left school prior to graduation and a control group of 97 boys and 84 girls who graduated from high school with a high school diploma or senior matriculation were selected for the study. Significant differences were found between the study group and the control group "on socio-economic status, attendance, formal schooling of parents, program offered by the school in which the student is registered, ethnicity and achievement level on the reading English language arts portion of Grade IX examination" (p. iv).

Elkin (1963) a sociologist, says that "children of lower social status tend to be perceived by school personnel as having less ability to benefit from education than children of higher status" (p. 114). He also notes that schools where pupils are predominantly lower status are more likely to be lower in morale and to seek transfer to "more desirable" schools than teachers in schools where pupils are predominantly middle class.

Taylor and Ayres (1972) have collected statistics in North-South differences and titled a book after their findings, Born and Bred Unequal. One of their concerns is with the economic and social factors which affect educational opportunity. Although their setting is England, perhaps some of the findings could apply in Zone One. They list such factors as highest incidence of death rate in the north, housing disparity and unemployment. "The consequences of this inequity are marked in all parts of the educational system by the age of school buildings, expenditures on schools, length of school life and moving to higher education" (p. 78).

G. AGE AND SEX DIFFERENCE

The British Columbia Mathematics Assessment (Robitaille, 1977) reports that at all three grade levels studied, the younger students outperformed their older counterparts. This they say "is not surprising since many of the older students at each level have been progressing through the system at a slower than average pace because they are less capable academically" (p. 35). In examining this phenomenon further however they found contradictory evidence.

> Of greater interest is the finding that, among Grade/Year 4 students born in 1967, there is a relationship between date of birth and achievement. Children born in the first quarter of 1967, that is between January and March, did better on all Grade/Year 4 test objectives than those born between April and December of the same year. In other words, among nine-year-olds, the older children outperformed the younger ones. (p. 35)

The age at which children enter school has been studied from both sociological and educational perspectives. Sociologists are concerned about the effects of early transfer of the home's role to the school. "The earlier the child comes to the school the greater the responsibility of the school as a socializing agency" (Elkin, 1972, p. 113). There may be some negative effects to this transfer of responsibility.

Moore (1975) in Better Late Than Early, a book that grew from research on the young child's mental development gives another concern.

> A number of research studies by brain specialists and by psychologists had suggested that the normal child's brain is not ready for sustained learning programs - until he is 8 to 10 years of age. Some specialists doubted even then that he should be forced into school. This was a surprising note, considering the nationwide trends toward early schooling. (p. xv)

Moore (1975) says that there are many factors which should be considered for the student's school entrance age. Moore uses the term integrated maturity level (IML) to encompass the child's maturation in such developmental areas as "vision, hearing, social-emotional progress and the activities of the central nervous system" (p. xvii). Their concerns for early school entrance are in part physiological. Hedges (1977) in attempting to answer the question At What Age Should Children Enter First Grade?, conducted a comprehensive search of the literature including nine dissertations, over two hundred and fifty articles, a number of research reports, and a few reviews of research. He labeled his findings "both startling and disturbing. In a number of instances, the literature cited by writers was limited, at times highly selective in the direction of their biases. In other instances data were either misinterpreted, ignored or overlooked..." (p.xii). He noted a definite swing in the literature. "A few years ago it was unpopular to 'push' a child. In more recent years, the emphasis has shifted toward early intervention and stimulation and even to the assumption that earlier is necessarily and automatically better" (p.xii). Ames (1967) in his book Is Your Child In The Wrong Grade?, says that "research conducted at the Gesell Institute in the past ten years revealed that at least one child in three may definitely be overplaced and struggling with the work of a grade which is really beyond his ability" (p.3).

With regard to sex differences the Mathematics Achievement Study (Rhodes, 1978) found that on the MACOSA project tests boys do better in mathematics. In the British Columbia Assessment (1977) boys outperformed girls on as many objectives as girls outperformed boys. "In general, the girls were superior on objectives dealing with skills and concepts which were lower on the scale of cognitive behaviors than those on which the boys obtained higher results" (p. 36). Most differences they suggest were very small.

Hedges (1977) looks at both sex and age differences when he writes that:

> There is general agreement among researchers, teachers and parents, that small, but clear sex differences in rate of development do exist. Our own clinical impression is that these amount to about 6 months in favor of girls around the time of school entrance. This is why we have maintained that a girl should be, on the average, fully 6 before starting first grade while boys do better if fully 6 1/2. (p. 39)

Carol Jacklin (1979) speaking at the 1979 Diagnostic and Prescriptive Mathematics Conference reported that the consensus of most male versus female mathematics achievement research is that either there are no differences or boys do better. The evidence also contends however, that "the differences are primarily due to the attitude and treatment differences that are shown within the classroom, the home and occupational environments" (Conference Address).

H. THE ZONE ONE STUDY IN PERSPECTIVE

The literature reviewed has pictured the interest that exists for suitable mathematics programs that will serve the best interests of individual pupils and society in general. With this expressed interest has come the call for assessment and evaluation data that will reveal the present skill, understanding and knowledge levels of students at all levels within the schools.

The present study combines the assessment and diagnostic and evaluation aspects of testing in elementary school mathematics in one particular geographical region of the province of Alberta. The assessment component of the study looks at the the individual and collective achievement of students in relation to the stated objectives of the 1977 Elementary Mathematics Program of Studies. The evaluation component of the study examines each of the objectives of the program in relation to how students are performing. The diagnostic aspect of the investigation is concerned with the instructional benefits of providing student achievement profiles to teachers and school supervisors.

CHAPTER III

INSTRUMENTATION AND RESEARCH PROCEDURES

A. INSTRUMENTATION

Zone One Testing Instruments

During the 1976-77 and 1977-78 school terms the Grande Prairie School District and the Regional Office of Education engaged in a test development project. The intent of the project was to produce evaluative instruments that would better match the mathematics objectives as outlined in the new Alberta elementary mathematics program.

Teachers at each grade level were given release time for the purpose of collecting, adapting and creating suitable test items. The final edition of the tests was to include an average of about two items for each objective in the program. With a total of 173 objectives in grades one to six over 350 validated items had to be approved.

Draft copies of grade level tests, upon completion, were referred to teacher committees who were to check for inherent ambiguities, poor readability, inaccuracies or lack of item clarity. A questionnaire (Appendix B) accompanied the draft test booklet in order to assist teachers in their examination of the test material. Suggested changes were discussed with the project coordinators and alterations were made where deemed advisable. Revisions to Grades I to VI tests were made and subsequently administered to approximately ten classes per grade level in the Grande

Prairie Public School system. This was considered to be the first stage in the validation of the tests at each grade level.

Pilot Testing

The purpose of the initial administration of the Zone One tests was primarily to establish validity of the mathematics items which were referenced to the program objectives. The tests were administered to students according to the schedule as shown in Table 2. Because of the time of the year and the newness of the program the tests were given upgrade; that is, one grade higher than designated.

TABLE 2
ADMINISTRATION SCHEDULE FOR PILOTING TESTS

DESIGNATED LEVEL OF TEST	GRADE LEVEL ADMINISTERED	DATE ADMINISTERED
Grade I	Grade II	January 1978
Grade II	Grade III	January 1978
Grade III	Grade IV	January 1978
Grade IV	Grade V	March 1978
Grade V	Grade VI	March 1978
Grade VI	Grade VI	March 1978

Teachers' Guides were also produced at each grade level both for ease and uniformity of administration. Teacher directions to students were explicit and detailed to the extent that the reading skills of students would not be a factor.

Marking keys were also produced in order to facilitate the marking of the tests and to ensure uniformity of scoring throughout the school system. Because the majority of test items were completion, short answer or calculation type, and partial marks alloted for work, these keys were vitally important.

Both teachers and school administrators took an active role in the piloting of test materials. The Teachers' Guide and marking keys received the same scrutiny that the tests were forced to undergo.

The Grande Prairie teachers who piloted the tests with students were actively involved in the revision teams which were assembled for follow-up action on the tests. Their involvement at this stage provided for the second step in the validation process. The knowledge that these teachers had of the students and their perceptions as to why students responded to the test items the way they did, proved valuable. Appendix C contains the pilot data for grades one, two and three students. Forms used to assemble the data are found in Appendix E and Appendix F. Teachers were able to perform a class average with the provision of a special form (Appendix D). The questionnaire form used by the Ad Hoc development committee is included as Appendix A.

Subsequent to the completion of the test materials a meeting with Zone One supervisory personnel was held to inform them of the project. Eventually all Zone One school systems chose to participate in the testing program for a two year trial period.

B. RESEARCH PROCEDURES

Data Collection

The revised forms of the Zone One Elementary Mathematics tests were administered in June of 1978 and 1979. These materials, published within the zone, were delivered to the central office of the school jurisdictions with the intent that administrative people distribute the Student Tests, Teacher Guides, Answer keys and Analysis Forms in appropriate numbers to their respective schools in time for an early June testing.

Meetings were scheduled with all supervisory personnel in the zone during May of 1978 for the purpose of involving these people in the administration of the assessment process. At these sessions with Principals, Assistant Superintendents and in some cases Superintendents, various aspects of the testing program were discussed; the design of the tests, purposes for testing and the details of administration were the main topics of these meetings. Informal question and answer type sessions were conducted with central office personnel during the 1979 delivery of materials. These same individuals had attended the 1978 meetings so a repeat inservice was considered unnecessary.

Teachers were required to correct their own students' tests. As mentioned, the marking keys were extensively detailed because of the allocation of partial marks for many of the completion type items. The following comment was included in the Teacher's Guides at each grade level.

> The scoring procedures used for the tests are intended to be simple and yet reflect the difficulty of the test item and the relative weighting of the strands. Total possible scores within the strands reflect the following emphasis.
>
> | | |
> |---|---|
> | Number | 30% - 40% |
> | Operations and Properties | 20% - 30% |
> | Measurement | 10% - 20% |
> | Geometry | 10% - 20% |
> | Graphing | 5% - 10% |
>
> (Grade 6 Teacher's Guide, p. 10)

For the 1978 testing the student marks from tests were tranferred by teachers to the Question Basis Section of the Student Analysis Form (Appendix F). An optical scanner form (Appendix G) was designed to replace the Student Analysis sheet for the 1979 data collectionn. Teachers were still required to mark and transfer the individual student scores as in the previous year. The optical scanner, however, eliminated the card punching and thus allowed a more rapid analysis of the data. Individual student, school and system computer print-outs were sent out in July of 1979 much earlier than the October shipment of the 1978 profiles.

In addition to transferring student test scores, teachers entered such information as student name, sex, the school and system numbers and the designation of early versus late starters. School and system code numbers were provided in the Administrative Directions (Appendix H) as was the method for identifying the students as early or late starters.

The School Jurisdictions, the number of schools within each system and the population of students within grades are provided in Appendix I. This information applies to 1978 only. The Zone One population of students within the grades of course varied slightly between the two testing years although not enough to be of any concern.

Scoring Reliability

The following procedure was used in determining the reliability of teachers marking their own students' tests. Six student test booklets from each of grades one, three and six were randomly selected from each of four elementary schools in the Peace River Public School District. These schools administered the Zone One tests in June of 1978, and had been instructed to package and forward the used and unused testing materials to their Divisional Office. The researcher rescored the total of 72 students' tests at the three grade levels. The variation between teacher and researcher scoring shown in Table 3 is not considered significant.

TABLE 3
COMPARING TEACHER AND RESEARCHER SCORING OF
TWENTY-FOUR SAMPLE TESTS IN EACH OF THREE GRADES

	GRADE I	GRADE III	GRADE VI
Teachers Scores	89	308	150
Researcher Scores	89	307	148

Reporting Results

As indicated, computerized print-outs that contained the achievement of individual pupils, the composite scores of students within each school, each school system and total zone were provided. Jurisdictions did not, however, receive each other's forms although all were given print-outs showing total student population, male-female, and early-late achievement profiles of each grade level, both for in and out of zone participants.

Additional Information

In November 1978 a discussion paper on the topic of mastery learning was sent to each school involved in the Zone One testing project. The contents of the paper included such aspects as the meaning and concerns of mastery learning and the possibilities of mastery programs answering to the weaknesses reflected in the 1978 measurement data. The purpose of the paper was also to provide a basis for a questionnaire (Appendix B) which was provided for each teacher. The purpose of the questionnaire was to gather the perceptions of individual teachers relative to the mathematics performances of Zone One students.

Teachers were requested to provide the following personal information in the first three questions in the questionnaire. (1) The grade they teach (they were to choose only one grade and use it for subsequent questions); (2) the number of years taught in Zone One, and; (3) the total years of teaching experience.

Part I of the questionnaire listed eight possible factors that could influence the opportunities that students have to achieve the elementary mathematics objectives. Teachers were to rank these factors as the most likely to the least likely to contribute to a lack of student success.

Part II was also a ranking question although here the teachers were asked to rank seven possible contributing factors in any successful mathematics program in general.

Part III of the questionnaire was based on the actual performances of students in the Zone. The lowest composite achievement scores of Zone One students in each strand, grades one to six, were listed and teachers were asked to choose one of six possible explanations as the best reason for the lowest scores.

Data Analysis

The following techniques were used for the analysis of the hypotheses.

Hypothesis One

A computer program that collects test item scores and matches them to the specific mathematics objectives they were validated to measure has been devised by the Division of Educational Research Services at the University of Alberta.

This program has been designed to report student achievement on objectives in percentage terms by strand and grade level. Individual student percentage scores will also be grouped to form composite percentage averages by school,

school system, total zone or out of zone categories. This analysis will be performed for the 1978 and 1979 data collected. A typical individual student profile used to report the 1978 results is shown in Table 4.

TABLE 4
A TYPICAL STUDENT PROFILE

I County of G.P.# 1 Beaverlodge Elementary
Student ID 10724 Grade Four (Tac to Analysis Form) June/78

Number	Operations & Properties	Measurement	Geometry	Graphing
1 25.0%	1 50.0%	1 60.0%	1 100.0%	1 100.0%
2 30.0%	2 37.5%	2 20.0%	2 100.0%	2 100.0%
3 100.0%	3 77.8%	3 33.3%	3 42.9%	3 100.0%
4 100.0%	4 40.0%	4 100.0%		4 75.0%
5 100.0%	5 60.0%	5 50.0%		
6 100.0%	6 38.9%	6 0.0%		
7 0.0%	7 25.0%	7 100.0%		
8 0.0%	8 50.0%	8 50.0%		
9 100.0%	9 22.2%	9 25.0		
	10 100.0%			
AVG61.7%	50.1%	48.7%	81.0%	93.8%

The statistical data for each of hypothesis one through six relating to the 173 objectives of the elementary mathematics program will be displayed as in Figure 4. Every objective will feature the test items which were referenced to it. Section I of the analysis in Figure 4 relates directly to hypothesis one and two which records the percentage of students achieving in each of the four criterion levels for both 1978 and 1979. A proportions test was used to determine whether or not student achievement within the two years was significantly different; Section II provides the statistical tables for hypothesis three through six.

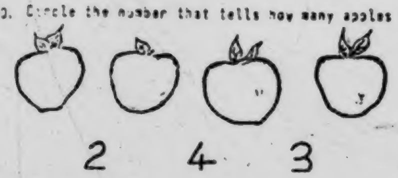
LEVEL A (Grade 1)

NUMBER

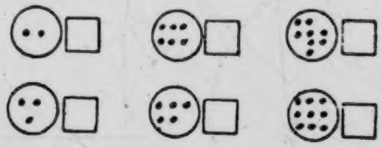
OBJECTIVE 3 *Associates a numeral with equivalent sets. (0-9) Cardinality.*

TEST ITEMS

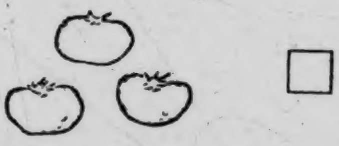
10. Circle the number that tells how many apples there are.



13. Count how many dots there are in each circle and print the number in the box by each circle.



11. Write in the box the number that tells how many tomatoes there are.



ANALYSIS

```
 ZONE ONE  PUPILS IN 1978 AND 1979 ACHIEVING WITHIN EACH CATAGORY A-D
      CRITERION CATEGORIES FOR     GRADE:1   STRAND:1   OBJECTIVE: 3
           TOTAL NUMBER OF PUPILS:  1978 N=2126   1979 N=1846

             A: BELOW 50%       B:  50-64%         C:  65-84%        D: 85-100%
           ____1978____1979______1978____1979______1978____1979_____1978_____1979_
NUMBER(%)    0.66      0.92      0.42     0.98      2.07     3.09     96.85    95.02
MEAN (%)    13.57     15.29     60.00    58.33     79.09    78.77     99.48    99.50

            TABLES COMPARING 1978 AND 1979 MEAN SCORES AND PROPORTIONS
   ___PROPORTION TEST___ #  ____________________F-TEST_________________________
   HO: PROPOR78=PROPOR79 #  ________SS________   ______DF______
   _T-CALC___DF____PROB_#  _BETWEEN______WITHIN_ BETWEEN WITHIN  F-RATIO  PROB
A:   -0.937  3970   0.349 #     22.78     9744.96    1        29    0.068  0.796
B:   -2.111  3970   0.035 #     16.67      250.00    1        25    1.667  0.209
C:   -2.033  3970   0.042 #      2.53      977.67    1        99    0.256  0.614
D:    2.938  3970   0.004 #      0.49    18592.01    1      3811    0.101  0.751

  ______COMPARING THE MEAN SCORES OF PUPILS WITHIN ZONE SUBGROUPS______
                                ___________________F-TEST TABLE____________________
GROUPS          YEARS       #   ________SS_________   ______DF______
======_______1978____1979__#  BETWEEN______WITHIN_  BETWEEN WITHIN  F-RATIO  PROB
EARLY        98.43   97.63  #   395.72   205713.95     1      2478    4.767  0.029
LATE         98.16   97.85  #    31.55   101856.00     1      1300    0.403  0.526
MALE         98.23   97.40  #   361.76   179970.42     1      2074    4.169  0.041
FEMALE       98.41   98.00  #    81.98   151628.09     1      1894    1.024  0.312
NORTH        98.34   99.00  #   117.96    57173.77     1      1074    2.216  0.137
SOUTH        98.31   97.22  #   871.11   273473.50     1      2894    9.218  0.003
```

FIGURE 4

OBJECTIVES, TEST ITEMS AND ANALYSIS

Hypothesis Two

A one-way analysis of variance will be the statistical procedure used to test for significant differences between the 1978 and 1979 composite performance of Zone One students in each of the five strands, grades one to six.

Hypothesis Three, Four, Five, and Six

The one-way analysis of variance design will be used to test for significant differences between the mathematics performance of early versus late starters, boys versus girls, North versus South Zone, and the Public versus Separate School Systems.

Analysis of the Questionnaire

Different types of statistical analysis will be used for examining the information from the teacher questionnaire. Part I and Part II of the questionnaire, as ranking items, will require a rank test for independent samples. The Pearson product moment correlation coefficient will be used for the statistical analysis of the ranking section of parts I and II of the questionnaire. The intent here is to see if years of teaching can be used as a predictor for teachers choosing particular factors that could influence achievement.

A series of Eta Squared tests will be used for the analysis of part III which was not a ranking item. Still the test will determine whether or not teaching experience can be utilized to predict the likelihood of teachers picking specific reasons for low achievement ratings.

The Analysis of the Objectives

Figure 4 illustrates how the analysis of each of the elementary mathematics objectives grades one to six will be displayed.

Each grade will be allocated a chapter beginning with Chapter IV for grade one through to Chapter IX for grade six.

A summary discussion related to student achievement within strands will be given at the conclusion of each chapter.

Chapter IX will report the results of the investigation in terms of the six hypotheses and in addition the findings from the questionnaire. A summary to include the implications and recommendations from the findings will be given in Chapter Eleven.

C. THE EFFECTIVENESS OF THE PRINT-OUTS

Question five in the statement of the problem section of Chapter One does not have a corresponding hypothesis to be tested. The question will, however, be handled in a descriptive way.

Since print-outs are provided for individual students, schools and school systems levels it seems appropriate to ask relevant questions in each of these categories. To do this a total of 15 teachers and 10 administrators will be randomly chosen from throughout the zone to answer specific questions concerning the effectiveness of the computerized forms.

The discussion of this question will necessarily look at utilization for the two separate years. The 1978 computer profiles of individual students contained only the student I.D. number and had to be matched with the student's corresponding Student Analysis for it to be of any use. These forms did not become available for teacher use until October of 1978, well into the school term. The 1979 optical scanned form was available in mid July and also contains the student's name. The questions relating to the 1979 profiles will deal with the teachers' and supervisors' anticipated use of the print-outs. This information will be collected during two separate visits to the zone and by telephone.

CHAPTER IV

GRADE ONE

ANALYSIS OF HYPOTHESIS ONE AND TWO FOR GRADE ONE

Notes on the Analysis

Figures 6 to 174, used in the analysis of hypothesis one and two, contain the mathematics program objectives (1978), the test items referenced to the objectives and the corresponding analysis of student achievement for grades one to six.

A discussion of the findings will be based on the analysis of the objectives although not all objectives will be discussed.

Part one of each analysis section contains two sets of numbers: line one gives the proportion (Number (%)) of pupils within each of four criterion categories A-D for both 1978 and 1979. These categories represent the achievement levels of below 50 percent, 50-64 percent, 65-84 percent, and 85-100 percent. Line two gives the mean percentage (mean (%)) for all pupils within each of the categories. The tables following these two lines contain the statistical data for comparing the proportions and the means for 1978 and 1979. The probabilities for the proportion test are displayed on the left while the F-test probabilities that compare the means for the two years are on the right.

The analysis section of the figures also includes a comparison of mean scores for the four pairs of Zone One subgroups. The probabilities associated with the F-tests in these tables compare only the same subgroup means for 1978 and 1979. Although the same subgroups are compared, for example, Early Starters for 1978 and 1979, the statistical program used in Chapter X will test difference between the Subgroup variables (eg. Early vs. Late Starters).

For the purposes of this study only those probabilities that are less than 0.02 level will be considered as statistically significant. This probability level represents what is considered to be educationally defensible mean and proportional differences. A detailed breakdown of the mark weighting alloted to each of the test items in the strands are included as the commencing figures for grades one to six (Chapters IV to IX). Figure 5 shows the grade one mark distribution.

Number(Five objectives tested, Figures 6 to 10)

Note: Objective five of the grade one Number strand in the Alberta program is the only objective not to be formally tested.

In regards to Hypothesis One, wherever eighty percent of the Zone One pupils reached the 85-100 percent category they did so for both 1978 and 1979. This was the case within each strand, grades one to six.

Hypothesis 1

Two objectives had performances where eighty percent of the Zone One pupils in 1978 and 1979 were within the 85-100 percent category.

Hypothesis 2

One objective had significant increases in the proportion of pupils achieving at the 85-100 percent level in 1979 over 1978.

Findings

Pupils' understanding of equivalent and non-equivalent sets was high. Eighty-seven percent of the pupils performed at the 100 percent level on the items measuring this objective.

Pupils also handle the 'more, fewer, greater than, less than and equal to' relationships with little difficulty. Seventy-four percent of the pupils in 1978 and 1979 received scores of 100 percent with an additional twenty percent achieving means of 66 percent.

Over ninety-five percent of grade one pupils could associate a numeral (0-9) with equivalent sets (cardinality) at the 85-100 percent level.

Pupils also had little difficulty with the order property of numbers. Seventy-eight percent of those tested in 1979 had achievement scores in the 85-100 percent

PART I

PART	QUESTION	STRAND	OBJECTIVE	RAW SCORE VALUE (same as percent)
I	1	Operations & Properties	1	2
I	2	Operations & Properties	1	2
I	3	Operations & Properties	2	3
I	4	Number	4	6
I	5	Number	1	3
I	6	Number	1	3
I	7	Number	2	2
I	8	Number	2	2
I	9	Number	2	2
I	10	Number	3	2
I	11	Number	3	2
I	12	Number	4	2
I	13	Number	3	6
I	14	Number	6	6
I	15	Operations & Properties	2	4
I	16	Number	6	4
I	17	Operations & Properties	2	3 ½ ea.
I	18	Operations & Properties	3	6
I	19	Operations & Properties	3	10

PART II

PART	QUESTION	STRAND	OBJECTIVE	RAW SCORE VALUE (same as percent)
II	1	Measurement	3	1
II	2	Measurement	4	1
II	3	Measurement	1	1 ½ ea.
II	4	Measurement	1	1 ½ ea.
II	5	Measurement	3	1
II	6	Measurement	5	1
II	7	Measurement	5	1
II	8	Measurement	5	1
II	9	Measurement	5	1
II	10	Measurement	5	1
II	11	Measurement	3	1
II	12	Measurement	6	1
II	13	Measurement	6	2
II	14	Geometry	1	must 4 be all correct
II	15	Geometry	2	1
II	16	Geometry	2	1
II	17	Geometry	2	1
II	18	Geometry	2	1
II	19	Graphing	1	2 (1 each row)
II	20	Graphing	1	3
II	21	Measurement	4	1
II	22	Measurement	4	1
II	23	Measurement	2	1

FIGURE 5

GRADE ONE DETAILED ANALYSIS OF MARK WEIGHTINGS

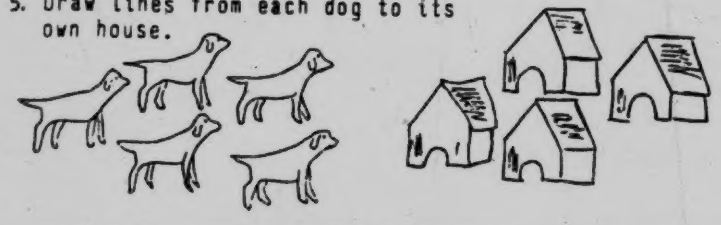
LEVEL A (Grade 1)

NUMBER

OBJECTIVE 1 *Matches members of two sets and determines equivalent and non-equivalent sets.*

TEST ITEMS

5. Draw lines from each dog to its own house.



6. Do all the dogs have houses? Circle yes or no.

Yes No

ANALYSIS

```
_ZONE ONE  PUPILS IN 1978 AND 1979 ACHIEVING WITHIN EACH CATAGORY A-D_
     CRITERION CATEGORIES FOR     GRADE:1   STRAND:1   OBJECTIVE: 1
           TOTAL NUMBER OF PUPILS:  1978 N=2126    1979 N=1846

            A: BELOW 50%       B:  50-64%        C:  65-84%         D: 85-100%
        ____1978____1979_____1978____1979_____1978____1979______1978____1979_
NUMBER(%)   3.10    3.79     7.90    8.18     0.24    0.49     88.76   87.54
MEAN (%)    0.51    0.0     50.00   50.00    80.00   81.48    100.00  100.00

          TABLES COMPARING 1978 AND 1979 MEAN SCORES AND PROPORTIONS
  ___PROPORTION TEST___ #  ____________________F-TEST______________________
  HO: PROPOR78=PROPOR79 #  _________SS________  ______DF______
  _T-CALC___DF____PROB_#__BETWEEN_____WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
A:  -1.189  3970   0.235 #     8.67     1094.28     1      134     1.061  0.305
B:  -0.321  3970   0.748 # <<<<<<<<<<<<< SSW IS EQUAL TO ZERO >>>>>>>>>>>>>>
C:  -1.338  3970   0.181 #     7.05      469.14     1       12     0.180  0.679
D:   1.186  3970   0.236 # <<<<<<<<<<<<< SSW IS EQUAL TO ZERO >>>>>>>>>>>>>>

     _____COMPARING THE MEAN SCORES OF PUPILS WITHIN ZONE SUBGROUPS______
                               ____________________F-TEST TABLE__________________
GROUPS          YEARS       #  _________SS________  ______DF______
======_____1978____1979__#__BETWEEN_____WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
EARLY       93.10    92.62 #    139.68 1162342.40    1      2478    0.298  0.585
LATE        92.57    90.67 #   1168.80  683134.83    1      1300    2.224  0.136
MALE        93.43    91.41 #   2116.49 1003435.85    1      2074    4.375  0.037
FEMALE      92.35    92.72 #     62.38  928559.13    1      1894    0.127  0.721
NORTH       92.52    92.17 #     32.94  551388.73    1      1074    0.064  0.800
SOUTH       93.07    91.98 #    853.45 1381871.77    1      2894    1.787  0.182
PUBLIC      92.72    92.38 #     90.08 1546679.86    1      3164    0.184  0.668
SEPARATE    93.73    90.74 #   1805.03  385544.02    1       804    3.764  0.053
```

FIGURE 6

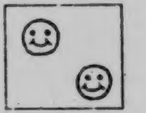
LEVEL A (Grade 1)

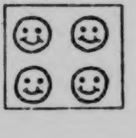
NUMBER

OBJECTIVE 2 *Describes relationships such as more, fewer, greater than, less than, equal to. (no symbols)*

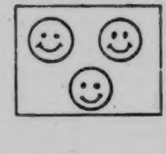
TEST ITEMS

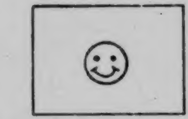
7. Look at the group of happy faces. Put an X on the box with fewer/less happy faces.



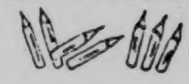


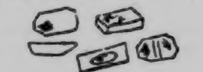
9. Look at the groups of happy faces. Put an X on the box with more happy faces.





8. Look at the sets of pencils and erasers.





There are less erasers than pencils. ☐

There are more erasers than pencils. ☐

Put an X in the box beside the sentence that is correct.

ANALYSIS

```
 ZONE ONE  PUPILS IN 1978 AND 1979 ACHIEVING WITHIN EACH CATAGORY A-D
     CRITERION CATEGORIES FOR     GRADE:1   STRAND:1   OBJECTIVE: 2
          TOTAL NUMBER OF PUPILS:  1978 N=2126    1979 N=1846

          A: BELOW 50%      B:  50-64%       C:  65-84%       D: 85-100%
          1978     1979     1978     1979     1978     1979     1978     1979
NUMBER(%)  4.56     5.04     0.09     0.16    21.12    20.80    74.22    74.00
MEAN (%)  29.55    24.73    50.00    50.00    66.78    66.84   100.00   100.00

           TABLES COMPARING 1978 AND 1979 MEAN SCORES AND PROPORTIONS
   ___PROPORTION TEST___ #  ___________________F-TEST_______________________
   HO: PROPOR78=PROPOR79 #  ________SS________  ______DF______
    T-CALC     DF     PROB #  BETWEEN     WITHIN  BETWEEN WITHIN  F-RATIO  PROB
A:  -0.700   3970   0.484 #  1104.00   30621.14     1      188    6.778   0.010
B:  -0.607   3970   0.544 #  <<<<<<<<<<<<<< SSW IS EQUAL TO ZERO >>>>>>>>>>>>>>
C:   0.245   3970   0.806 #     0.80    1927.30     1      831    0.346   0.557
D:   0.162   3970   0.871 #  <<<<<<<<<<<<<< SSW IS EQUAL TO ZERO >>>>>>>>>>>>>>


    _____COMPARING THE MEAN SCORES OF PUPILS WITHIN ZONE SUBGROUPS _____
                            ___________________F-TEST TABLE__________________
GROUPS         YEARS      #  ________SS________  ______DF______
======      1978    1979  #  BETWEEN     WITHIN  BETWEEN WITHIN  F-RATIO  PROB
EARLY      89.84   89.80  #     1.06  922639.51     1     2478    0.003   0.957
LATE       89.46   87.96  #   734.08  526563.45     1     1300    1.812   0.178
MALE       89.57   88.07  #  1166.74  848369.09     1     2074    2.852   0.092
FEMALE     89.89   90.52  #   189.01  681182.16     1     1894    0.526   0.469
NORTH      90.45   91.93  #   581.32  341584.11     1     1074    1.828   0.177
SOUTH      89.44   88.28  #   974.47 1185630.42     1     2894    2.379   0.123
PUBLIC     89.71   89.41  #    73.97 1188666,91     1     3164    0.197   0.657
SEPARATE   89.77   88.58  #   283.62  343503.60     1      804    0.664   0.415
```

FIGURE 7

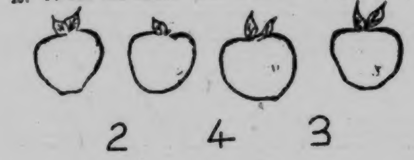
LEVEL A (Grade 1)

NUMBER

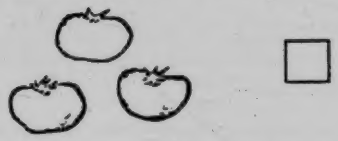
OBJECTIVE 3 *Associates a numeral with equivalent sets. (0-9) Cardinality.*

TEST ITEMS

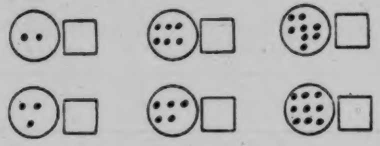
10. Circle the number that tells how many apples there are.



11. Write in the box the number that tells how many tomatoes there are.



13. Count how many dots there are in each circle and print the number in the box by each circle.



ANALYSIS

```
 _ZONE ONE__PUPILS IN 1978 AND 1979 ACHIEVING WITHIN EACH CATAGORY A-D_
      CRITERION CATEGORIES FOR     GRADE:1   STRAND:1   OBJECTIVE: 3
           TOTAL NUMBER OF PUPILS:  1978 N=2126    1979 N=1846

            A: BELOW 50%      B:  50-64%       C:  65-84%        D: 85-100%
        ____1979____1979_____1978___1979_____1978____1979_____1978____1979_
NUMBER(%)   0.66     0.92     0.42     0.98     2.07     3.09    96.85   95.02
MEAN (%)   13.57    15.29    60.00    58.33    79.09    78.77    99.48   99.50

            TABLES COMPARING 1978 AND 1979 MEAN SCORES AND PROPORTIONS
   ___PROPORTION TEST___ #  ____________________F-TEST______________________
   HO: PROPOR78=PROPOR79 #  ________SS________  ______DF______
   _T-CALC___DF____PROB_#__BETWEEN______WITHIN__BETWEEN WITHIN__F-RATIO__PROB
A:  -0.937  3970   0.349 #     22.78     9744.96     1        29    0.068  0.796
B:  -2.111  3970   0.035 #     16.67      250.00     1        25    1.667  0.209
C:  -2.033  3970   0.042 #      2.53      977.67     1        99    0.256  0.614
D:   2.938  3970   0.004 #      0.49    18592.01     1      3811    0.101  0.751

   _____COMPARING THE MEAN SCORES OF PUPILS WITHIN ZONE SUBGROUPS______
                           ____________________F-TEST TABLE__________________
GROUPS       YEARS      #  ________SS________  ______DF______
======_____1978____1979_#__BETWEEN______WITHIN__BETWEEN WITHIN__F-RATIO__PROB
EARLY       98.43   97.63 #   395.72  205713.95     1      2478    4.767  0.029
LATE        98.16   97.85 #    31.55  101856.00     1      1300    0.403  0.526
MALE        98.23   97.40 #   361.76  179970.42     1      2074    4.169  0.041
FEMALE      98.41   98.00 #    81.98  151628.09     1      1894    1.024  0.312
NORTH       98.34   99.00 #   117.96   57173.77     1      1074    2.216  0.137
SOUTH       98.31   97.22 #   871.11  273473.50     1      2894    9.218  0.003
PUBLIC      98.54   97.72 #   529.90  230108.04     1      3164    7.286  0.007
SEPARATE    97.40   97.54 #     3.68  101233.05     1       804    0.029  0.864
```

FIGURE 8

LEVEL A (Grade 1)

NUMBER

OBJECTIVE 4

Demonstrates knowledge of the order property of numbers by ordering sets by relative size, by counting, and by arranging digits in order. (Ordinality)

TEST ITEMS

4. Write in the missing numbers.

(A) What comes before

_____ 40, 41

_____ 7, 8

(B) What comes between

56 _____ 58

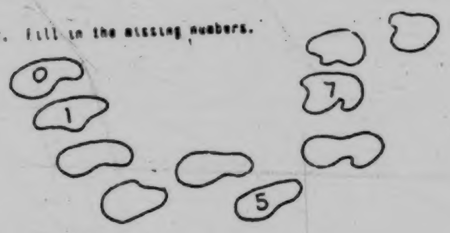
9 _____ 11

(C) What comes after

4, 5 _____

79, 80 _____

12. Fill in the missing numbers.



ANALYSIS

```
 _ZONE ONE__PUPILS_IN_1978_AND_1979_ACHIEVING_WITHIN_EACH_CATAGORY_A-D_
     CRITERION CATEGORIES FOR    GRADE:1   STRAND:1   OBJECTIVE: 4
          TOTAL NUMBER OF PUPILS:  1978 N=2126    1979 N=1846

            A: BELOW 50%       B:  50-64%        C:  65-84%        D: 85-100%
         ___1978___1979____1978___1979____1978___1979____1978___1979_
NUMBER(%)   4.61     4.33     7.24     7.42     9.03     9.75    79.12    78.49
MEAN (%)   25.38    22.97    57.47    58.12    75.00    75.00    97.61    97.42

          TABLES COMPARING 1978 AND 1979 MEAN SCORES AND PROPORTIONS
   ___PROPORTION TEST___ #  ____________________F-TEST______________________
   HC: PROPOR78=PROPOR79 #  ________SS________   ______DF______
   _T-CALC___DF____PROB_#__BETWEEN_____WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
A:   0.419   3970   0.675 #   256.65   31218.07     1      176     1.447   0.231
B:  -0.214   3970   0.830 #    30.91   10659.60     1      289     0.838   0.361
C:  -0.777   3970   0.438 # <<<<<<<<<<<<<< SSW IS EQUAL TO ZERO >>>>>>>>>>>>>>
D:   0.478   3970   0.633 #    27.04   77759.11     1     3129     1.088   0.297

   ______COMPARING THE MEAN SCORES OF PUPILS WITHIN ZONE SUBGROUPS______
                            ____________________F-TEST TABLE______________
GROUPS        YEARS       # ________SS________   ______DF______
======______1978____1979_#_BETWEEN_____WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
EARLY        89.79   89.78 #     0.09   851076.27    1     2478     C.000   0.987
LATE         88.61   88.15 #    69.14   510745.47    1     1300     0.176   0.675
MALE         88.39   88.25 #    11.41   812482.19    1     2074     0.029   0.865
FEMALE       90.34   90.03 #    44.14   632888.92    1     1894     0.132   0.716
NORTH        89.71   90.80 #   318.65   355615.37    1     1074     0.962   0.327
SOUTH        89.18   88.49 #   346.45  1091208.92    1     2894     0.919   0.338
PUBLIC       89.30   89.54 #    44.88  1129331.50    1     3164     0.126   0.723
SEPARATE     89.44   87.44 #   809.79   318132.52    1      804     2.047   0.153
```

FIGURE 9

LEVEL A (Grade 1)

NUMBER

OBJECTIVE 6 *Identifies and renames the number of 10's and the number of 1's in any 2 digit number.*

TEST ITEMS

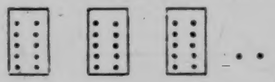
14. How many tens and ones in each number. Write your answer in the blanks.

63 means ____ tens and ____ ones

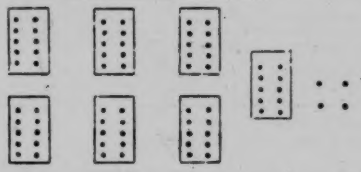
46 means ____ tens and ____ ones

70 means ____ tens and ____ ones

16. (A) How many tens? _____ How many ones? _____



(B) How many tens? _____ How many ones? _____



ANALYSIS

```
 ZONE ONE  PUPILS IN 1978 AND 1979 ACHIEVING WITHIN EACH CATAGORY A-D
     CRITERION CATEGORIES FOR    GRADE:1   STRAND:1   OBJECTIVE: 5
           TOTAL NUMBER OF PUPILS:  1978 N=2126   1979 N=1846

            A: BELOW 50%      B:  50-64%        C:  65-84%       D: 85-100%
           1978     1979     1978    1979      1978    1979     1978    1979
NUMBER(%)  30.06    25.41    5.93    6.12      8.80    9.32     55.22   59.15
MEAN (%)   24.87    25.59    58.73   57.88     78.29   78.95    99.28   99.51

          TABLES COMPARING 1978 AND 1979 MEAN SCORES AND PROPORTIONS
   ___PROPORTION TEST___ #  ___________________F-TEST______________________
   HO: PROPOR78=PROPOR79 #  ________SS________  ______DF______
    T-CALC    DF    PROB #  BETWEEN     WITHIN  BETWEEN WITHIN  F-RATIO  PROB
A:   3.259   3970   0.001 #   139.97  303327.45    1     1106    0.510   0.475
B:  -0.257   3970   0.797 #    43.45    3287.09    1      237    3.133   0.078
C:  -0.572   3970   0.568 #    39.59    4264.03    1      357    3.314   0.070
D:  -2.498   3970   0.013 #    29.97   12841.74    1     2264    5.284   0.022


      _____COMPARING THE MEAN SCOPES OF PUPILS WITHIN ZONE SUBGROUPS _____
                               ___________________F-TEST TABLE_________________
GROUPS       YEARS      #  ________SS________  ______DF______
======     1978   1979  #  BETWEEN    WITHIN   BETWEEN WITHIN  F-RATIO  PROB
EARLY      73.30  77.36 #  10155.22 2696766.72    1     2478    9.331   0.002
LATE       71.57  74.55 #   2878.06 1543114.26    1     1300    2.425   0.120
MALE       71.80  75.36 #   6541.98 2405886.92    1     2074    5.640   0.018
FEMALE     73.60  77.28 #   6366.49 2070868.11    1     1894    5.823   0.016
NORTH      76.94  75.84 #    321.36 1164516.93    1     1074    0.296   0.586
SOUTH      71.01  76.42 #  21133.79 3300432.93    1     2894   18.531   0.000
PUBLIC     72.52  76.28 #  11116.66 3558029.14    1     3164    9.886   0.002
SEPARATE   73.28  76.22 #   1742.68  921941.68    1      804    1.520   0.218
```

FIGURE 10

category.

Pupils had some problems with identifying and renaming the number of 10's and 1's in any 2 digit number (place value). Here only about sixty percent of the 1979 group reached category D and significantly fewer did in 1978. About one-quarter of the grade one's achieved within category A (below 50 percent) in 1979, about five percent fewer than did so in 1978.

Operations and Properties (Three objectives; figures 11 to 13).

Hypothesis 1

One objective had achievement proportions in 1978 and 1979 where eighty percent of the Zone One pupils were in the 85-100 percent category.

Hypothesis 2

One objective had a significant increase in the proportion of pupils achieving in the 85-100 percent category from 1978 to 1979.

Findings

Zone One pupils have a good understanding of the process of addition and subtraction in concrete situations. Close to ninety percent of these pupils were in category D(85-100 percent). They did have difficulty with the symbolizing aspect of addition and subtraction situations however. Some fifteen percent scored below the 50 percent

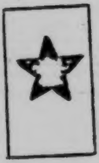
OPERATIONS AND PROPERTIES

LEVEL A (Grade 1)

OBJECTIVE I *Understands the process of addition and subtraction.*

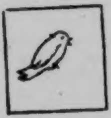
TEST ITEMS

1.



SUBTRACT − ADD +

2.



SUBTRACT − ADD+

ANALYSIS

```
ZONE ONE  PUPILS IN 1978 AND 1979 ACHIEVING WITHIN EACH CATAGORY A-D
    CRITERION CATEGORIES FOR     GRADE:1   STRAND:2   OEJECTIVE: 1
         TOTAL NUMBER OF PUPILS:  1978 N=2126    1979 N=1846

                                                C:  65-84%          D: 85-100%
             A: BELOW 50%        B:  50-64%
                                                                  1978    1979
           1978     1979       1978    1979     1978    1979     88.48   89.22
NUMBER(%)   5.36     4.93       6.16    5.58     0.0     0.27    100.00  100.00
MEAN (%)    0.88     0.27      50.00   50.00    ******   75.00

          TABLES COMPARING 1978 AND 1979 MEAN SCORES AND PROPORTIONS
                                    #  --------------------F-TEST---------------------
   PROPORTION TEST                  #  --------SS--------  --------DF------
   HO: PROPOR78=PROPOR79            #                                              F-RATIO  PROB
                                                                                   1.230    0.269
                                       BETWEEN      WITHIN  BETWEEN  WITHIN
                                                                     203
   T-CALC      DF       PROB        #    18.37     3030.41     1
A:    0.615    3970     0.539       #  <<<<<<<<<<<<<< SSW IS EQUAL TO ZERO >>>>>>>>>>>>>>
B:    0.777    3970     0.437       #  <<<<<<<< TOO FEW PUPILS FOR CALCULATIONS >>>>>>>>
C:   -2.401    3970     0.016       #  <<<<<<<<<<<<<< SSW IS EQUAL TO ZERO >>>>>>>>>>>>>>
D:   -0.742    3970     0.458       #

          COMPARING THE MEAN SCORES OF PUPILS WITHIN ZONE SUBGROUPS
      ------------------------------F-TEST TABLE-----------------------------
                                  ---------------------  --------DF------
GROUPS          YEARS          #  --------SS--------                          F-RATIO  PROB
======        1978    1979     #   BETWEEN     WITHIN   BETWEEN  WITHIN       1.103    0.294
EARLY         91.97   92.97    #    620.24  1392867.41     1       2478       0.006    0.940
LATE          91.41   91.30    #      3.55   820290.23     1       1300       0.011    0.917
MALE          90.40   90.28    #      7.54  1427599.64     1       2074       2.155    0.142
FEMALE        92.91   94.39    #   1042.45   916097.59     1       1894       0.874    0.350
NORTH         89.83   91.32    #    589.10   724119.89     1       1074       0.082    0.774
SOUTH         92.29   92.55    #     46.25  1627581.29     1       2894       1.512    0.219
PUBLIC        91.25   92.32    #    904.02  1891856.56     1       3164       0.509    0.476
SEPARATE      93.08   91.88    #    292.12   461795.35     1        804
```

FIGURE 11

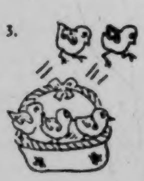
LEVEL A (Grade 1)

OPERATIONS AND PROPERTIES

OBJECTIVE 2 *Symbolizes addition and subtraction situations.*

TEST ITEMS

3.



5 □ 2 = 3

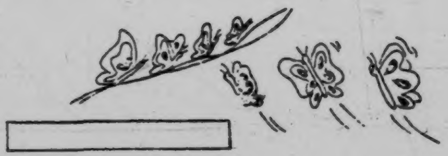
17.

4 □ 1 = 5

3 □ 2 = 1

6 □ 3 = 3

15.



ANALYSIS

```
_ZONE ONE__PUPILS_IN_1978_AND_1979_ACHIEVING_WITHIN_EACH_CATAGORY_A-D_
    CRITERION CATEGORIES FOR     GRADE:1    STRAND:2    OBJECTIVE: 2
         TOTAL NUMBER OF PUPILS:  1978 N=2126     1979 N=:846

            A: BELOW 50%      B:  50-64%       C:  65-84%       D: 85-100%
         ____1978____1979_____1978____1979_____1978____1979______1978____1979_
NUMBER(%)   16.93    14.30    25.31    22.70      4.94     6.01    52.82    56.99
MEAN (%)    20.78    21.59    57.16    56.56     75.24    75.59    98.89    98.35

          TABLES COMPARING 1978 AND 1979 MEAN SCORES AND PROPORTIONS
   ___PROPORTION TEST___ #  ___________________F-TEST________________________
   HO: PROPOR78=PROPOR79 #  ________SS________  _______DF______
   _T-CALC____DF____PROB_#__BETWEEN______WITHIN_BETWEEN_WITHIN__F-RATIO__PROB
A:    2.274   3970   0.023 #     100.70  131914.04      1       622     0.475   0.491
B:    1,917   3970   0,085 #      82.80   20399.96      1       955     3.876   0.049
C:   -1.489   3970   0.137 #       6.52    5355.98      1       214     0.260   0.610
D:   -2.631   3970   0.009 #     158.92   25630.69      1      2173    13.473   0.000

   ______COMPARING_THE_MEAN_SCORES_OF_PUPILS_WITHIN_ZONE_SUBGROUPS_______
                            ___________________F-TEST TABLE____________________
GROUPS          YEARS       #  ________SS________  _______DF______
======______1978____1979__#__BETWEEN______WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
EARLY        74.23   77.22 #    5512.16 2143156.22     1     2478     6.373   0.012
LATE         72.79   75.41 #    2226.88 1213984.87     1     1300     2.385   0.123
MALE         71.90   74.51 #    3505.01 1961868.40     1     2074     3.705   0.054
FEMALE       76.13   78.75 #    3252.73 1536396.59     1     1894     4.010   0.045
NORTH        78.03   76.32 #     780.89  908786.02     1     1074     0.923   0.337
SOUTH        72.34   76.59 #   13020.42 2593319.87     1     2894    14.530   0.000
PUBLIC       73.27   76.23 #    6854.08 2863456.12     1     3164     7.573   0.006
SEPARATE     76.67   77.59 #     168.28  648153.81     1      804     0.209   0.648
```

FIGURE 12

LEVEL A (Grade 1)

OPERATIONS
AND PROPERTIES

OBJECTIVE 3 *Demonstrates mastery of the basic facts involving sums and minuends through 9.*

TEST ITEMS

18. Write the answers for each problem in the boxes.

4 + 5 = ☐ 5 + 4 = ☐

6 − 5 = ☐ 7 − 3 = ☐

7 − 0 = ☐ 6 + 1 = ☐

19. Write the answers for each problem in the boxes.

8	8	7	3	4
+ 0	− 3	− 5	+ 2	+ 4
☐	☐	☐	☐	☐

3	5	8	6	7
+ 6	− 2	+ 1	− 2	+ 1
☐	☐	☐	☐	☐

ANALYSIS

```
 _ZONE_ONE__PUPILS_IN_1978_AND_1979_ACHIEVING_WITHIN_EACH_CATAGORY_A-D_
     CRITERION CATEGCRIES FOR    GRADE:1   STRAND:2   OBJECTIVE: 3
          TOTAL NUMBER OF PUPILS:  1978 N=2126    1979 N=1846

           A: BELOW 50%      B:  50-64%        C:  65-84%        D: 85-100%
       ____1978___1979_____1978___1979_____1978___1979_____1978____1979_
NUMBER(%)   5.41    5.85     5.17    6.34    12.79   12.78    76.62   75.03
MEAN (%)   20.33   21.59    57.95   57.80    77.11   76.32    96.23   96.56

         TABLES COMPARING 1978 AND 1979 MEAN SCORES AND PROPORTIONS
   ___PROPORTION TEST___ #  _____________________F-TEST___________________
   HO: PROPOR78=PROPOR79 #  _________SS________  ______DF______
   _T-CALC___DF____PROB_#_BETWEEN_____WITHIN_BETWEEN_WITHIN__F-RATIO__PROB
A:  -0.683  3970   0.547 #     88.36   60799.04     1      221    0.321  0.571
B:  -1.576  3970   0.115 #      1.37    5219.93     1      225    0.059  0.808
C:   0.009  3970   0.993 #     78.83   12901.92     1      506    3.091  0.079
D:   1.172  3970   0.241 #     80.70   64159.46     1     3012    3.789  0.052

   ______COMPARING_THE_MEAN_SCORES_OF_PUPILS_WITHIN_ZONE_SUBGROUPS______
                           ___________________F-TEST TABLE________________
GRCUPS          YEARS        #   _________SS________   ______DF______
======_____1978____1979___#__BETWEEN____WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
EARLY      87.87   87.87  #     0.00   951317.27     1       2478   0.000  0.999
LATE       87.46   85.80  #   897.10   584291.79     1       1300   1.996  0.158
MALE       86.59   85.60  #   501.92   884726.13     1       2074   1.177  0.278
FEMALE     88.89   88.82  #     2.40   734335.00     1       1894   0.006  0.937
NORTH      87.80   88.42  #   101.56   441097.90     1       1074   0.247  0.619
SOUTH      87.66   86.67  #   698.55  1184455.32     1       2894   1.707  0.192
PUBLIC     87.42   86.90  #   213.98  1356735.79     1       3164   0.499  0.480
SEPARATE   88.83   87.96  #   154.17   268908.96     1        804   0.461  0.497
```

FIGURE 13

level and only fifty-seven percent of the pupils in 1979 achieved to the 85-100 percent level. Three quarters of the grade one pupils had mastered the basic facts involving sums and minuends through 9. Mean scores for all student sub-groups on the basic facts were in the high 80 percent range.

Measurement (Six Objectives; Figures 14 to 19)

Hypothesis 1

Two objectives had achievement performances where eighty percent of the Zone One pupils were in the 85-100 percent range in both 1978 and 1979. As noted earlier wherever such proportions existed they did so for both years.

Hypothesis 2

None of the measurement objectives had significant increases in the proportions of pupils in category D for 1979 over 1978.

Findings

Over eighty-five percent of the zone one pupils could tell time to the nearest hour with 100 percent accuracy. Fewer were able to read the days of the week in order however. About thirty percent of these individuals had zero performance on the days of the week item. No significant gains were recorded for 1979.

Grade one students do well with non-standard measurement. They handled gross comparisons such as longer

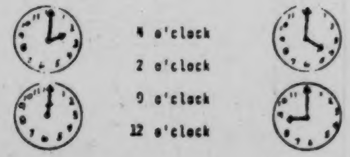
LEVEL A (Grade 1)

MEASUREMENT

OBJECTIVE 1 *Tells the time to hour.*

TEST ITEMS

3.



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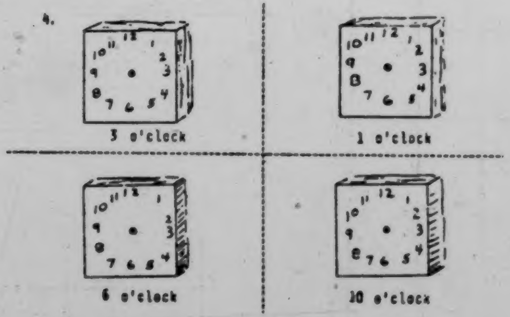


ANALYSIS

```
 _ZONE ONE  PUPILS IN 1978 AND 1979 ACHIEVING WITHIN EACH CATAGORY A-D
     CRITERION CATEGCRIES FOR     GRADE:1   STRAND:3   OBJECTIVE: 1
           TOTAL NUMBER OF PUPILS:  1978 N=2126   1979 N=1846

          A: BELOW 50%       B: 50-64%        C:  65-84%        D: 85-100%
        ____1978____1979_____1978____1979_____1978____1979_____1978____1979_
NUMBER(%)   4.14     4.66      9.97     9.26      0.0      0.0      85.89   86.08
MEAN (%) .  0.0      0.0      50.00    50.00    ******   ******   100.00  100.00

            TABLES COMPARING 1978 AND 1979 MEAN SCORES AND PROPORTIONS
   ___PROPORTION TEST___ #  ____________________F-TEST_______________________
   HO: PROPOR78=PROPOR79 #  ________SS________  ______DF______
   _T-CALC___DF____PROB_#  BETWEEN_____WITHIN_ BETWEEN WITHIN__F-RATIO__PROB
A:  -0.798   3970   0.425 #  <<<<<<<<<<<<<< SSW IS EQUAL TO ZERO >>>>>>>>>>>>>>
B:   0.754   3970   0.451 #  <<<<<<<<<<<<<< SSW IS EQUAL TO ZERO >>>>>>>>>>>>>>
C:   0.0     3970   1.000 #  <<<<<<<< TOO FEW PUPILS FOR CALCULATIONS >>>>>>>>
D:  -0.171   3970   0.864 #  <<<<<<<<<<<<<< SSW IS EQUAL TO ZERO >>>>>>>>>>>>>>


   ______COMPARING THE MEAN SCORES OF PUPILS WITHIN ZONE SUBGROUPS_____
                                  ____________________F-TEST TABLE_____________________
GROUPS         YEARS        #  ________SS________  ______DF______
======_____1978____1979___#__BETWEEN_____WITHIN__BETWEEN WITHIN__F-RATIO__PROB
EARLY       91.01    91.40 #      91.90 1419899.02      1       2478     0.160   0.689
LATE        90.88    90.25 #     126.14  777118.48      1       1300     0.211   0.646
MALE        90.58    90.12 #     107.60 1287214.17      1       2074     0.173   0.677
FEMALE      91.19    91.36 #      13.27 1073023.39      1       1894     0.023   0.878
NORTH       91.93    91.27 #     117.48  539603.71      1       1074     0.234   0.629
SOUTH       90.46    90.51 #       1.74 1820411.76      1       2894     0.003   0.958
PUBLIC      91.45    90.98 #     177.20 1804093.97      1       3164     0.311   0.577
SEPARATE    88.47    89.72 #     314.66  853605.94      1        804     0.457   0.499
```

FIGURE 14

LEVEL A (Grade 1)

MEASUREMENT

OBJECTIVE 2 *Recites the days of the week in order.*

TEST ITEMS

QUESTION 23

Say, "Name the days of the week starting with Sunday."

The student responds correctly if he orally names all the days of the week in the correct order. Mark his answer on the student's test sheet.

23.

Correct / Incorrect

ANALYSIS

```
 ZONE ONE  PUPILS IN 1978 AND 1979 ACHIEVING WITHIN EACH CATAGORY A-D
      CRITERION CATEGORIES FOR     GRADE:1    STRAND:3    OBJECTIVE: 2
           TOTAL NUMBER OF PUPILS:  1978 N=2126    1979 N=1846

                                                                D: 85-100%
             A: BELOW 50%       B:  50-64%         C:  65-84%
                                1978     1979      1978     1979      1978     1979
          1978      1979        0.0      0.0       0.0      0.0       69.90    71.24
NUMBER(%)  30.10     28.76      ******   ******    ******   ******   100.00   100.00
MEAN (%)   0.0       0.0

           TABLES COMPARING 1978 AND 1979 MEAN SCORES AND PROPORTIONS
                                 ____________________F-TEST________________________
   ___PROPORTION TEST___ #       ________SS________     ______DF______
   HO: PROPOR78=PROPOR79 #       BETWEEN       WITHIN   BETWEEN WITHIN  F-RATIO  PROB
    T-CALC     DF     PROB #     <<<<<<<<<<<<<< SSW IS EQUAL TO ZERO >>>>>>>>>>>>>>>
A:   0.923    3970    0.356 #    <<<<<<<<< TOO FEW PUPILS FOR CALCULATIONS >>>>>>>>>
B:   0.0      3970    1.000 #    <<<<<<<<< TOO FEW PUPILS FOR CALCULATIONS >>>>>>>>>
C:   0.0      3970    1.000 #    <<<<<<<<<<<<<< SSW IS EQUAL TO ZERO >>>>>>>>>>>>>>>
D:  -0.923    3970    0.356 #

        COMPARING THE MEAN SCORES OF PUPILS WITHIN ZONE SUBGROUPS ______
  ______                         ____________________F-TEST TABLE__________________
                                 ________SS________     ______DF______
GPOUPS          YEARS        #   BETWEEN       WITHIN   BETWEEN WITHIN  F-RATIO  PROB
======       1978     1979   #          40.02 5037181.75      1      2478    0.020   0.888
EARLY        71.54    71.79  #        4626.26 2727170.98      1      1300    2.205   0.138
LATE         68.32    72.10  #        1471.90 4588292.07      1      2074    0.665   0.415
MALE         66.21    67.90  #         537.40 3613703.11      1      1894    0.282   0.596
FEMALE       73.87    74.94  #        6860.50 2078817.94      1      1074    3.544   0.060
NORTH        71.43    76.51  #           4.19 6157122.88      1      2894    0.002   0.965
SOUTH        69.30    69.38  #        7457.68 6333202.46      1      3164    3.726   0.054
PUBLIC       70.89    73.97  #        4278.65 1863314.40      1       804    1.846   0.175
SEPARATE     65.78    61.17  #
```

FIGURE 15

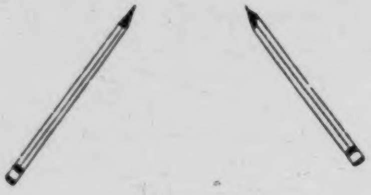
LEVEL A (Grade 1)

MEASUREMENT

OBJECTIVE 3 *Compares two or more objects as shorter than, longer than, thinner than, thicker than, heavier than, lighter than, etc.*

TEST ITEMS

1. Use paper clips to measure the two pencils. Circle the pencil that is longer than the other.



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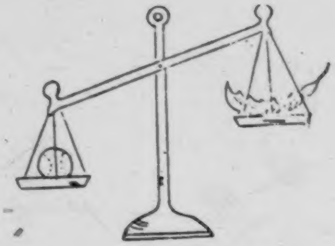

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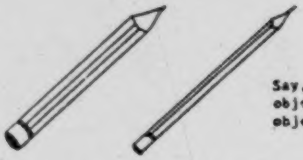


Say, "In question 11 at the top of the page, the balance scale shows two objects being weighed. Circle the heavier object—circle the heavier object."

Say, "In question 5, at the bottom of the page, there are two pencils. Circle the pencil that is thinner than the other—circle the pencil that is thinner."

ANALYSIS

```
  _ZONE ONE  PUPILS IN 1978 AND 1979 ACHIEVING WITHIN EACH CATAGORY A-D_
      CRITERION CATEGORIES FOR    GRADE:1   STRAND:3   OBJECTIVE: 3
           TOTAL NUMBER OF PUPILS:  1978 N=2126    1979 N=1846

            A: BELOW 50%      B:  50-64%       C:  65-84%       D: 85-100%
       ____1978____1979____1978____1979_____1978___1979_____1978____1979_
NUMBER(%)   1.36    2.60    0.0     0.0      9.88    8.13    88.76   89.27
MEAN (%)   17.24   15.97  ******  ******    66.67   66.67   100.00  100.00

          TABLES COMPARING 1978 AND 1979 MEAN SCORES AND PROPORTIONS
   ___PROPORTION TEST___ #  ____________________F-TEST____________________
   HO: PROPOR78=PROPOR79 #  ________SS________  ______DF______
   _T-CALC___DF____PROB_# _BETWEEN_____WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
A:  -2.818  3970   0.005 #    29.12   21356.16    1        75     0.102  0.750
B:   0.0    3970   1.000 #  <<<<<<<< TOO FEW PUPILS FOR CALCULATIONS >>>>>>>>
C:   1.918  3970   0.055 #  <<<<<<<<<<<<< SSW IS EQUAL TO ZERO >>>>>>>>>>>>>
D:  -0.518  3970   0.604 #  <<<<<<<<<<<<< SSW IS EQUAL TO ZERO >>>>>>>>>>>>>

   ______COMPARING THE MEAN SCORES OF PUPILS WITHIN ZONE SUBGROUPS ______
                            ____________________F-TEST TABLE_______________
GROUPS        YEARS       #  ________SS________  ______DF______
======_____1978____1979__#__BETWEEN_____WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
EARLY       95.66   95.14 #   164.84  522182.38    1      2478    0.782  0.377
LATE        95.57   94.73 #   224.85  300724.11    1      1300    0.972  0.324
MALE        95.77   94.96 #   342.58  450016.55    1      2074    1.579  0.209
FEMALE      95.37   95.27 #     4.50  422974.87    1      1894    0.020  0.887
NORTH       95.57   96.67 #   321.47  173023.23    1      1074    1.995  0.158
SOUTH       95.58   94.55 #   759.48  698502.34    1      2894    3.147  0.076
PUBLIC      95.74   94.90 #   551.20  707862.15    1      3164    2.464  0.117
SEPARATE    94.90   95.85 #   182.36  164747.33    1       804    0.890  0.346
```

FIGURE 16

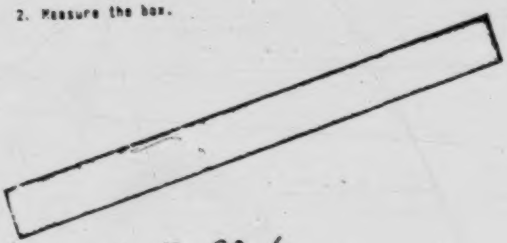
LEVEL A (Grade 1)

MEASUREMENT

OBJECTIVE 4 *Estimates and measures unsing non-standard units of capacity, mass and linear measures.*

TEST ITEMS

2. Measure the box.



2 10 80 4

22.

X 2 4 20 5

21.

2 8 5 4

ANALYSIS

```
 ZONE ONE  PUPILS IN 1978 AND 1979 ACHIEVING WITHIN EACH CATAGORY A-D
     CRITERION CATEGORIES FOR     GRADE:1   STRAND:3   OBJECTIVE: 4
             TOTAL NUMBER OF PUPILS:  1978 N=2126    1979 N=1846

              A: BELOW 50%       B:  50-64%        C:  65-84%         D: 85-100%
              1978     1979     1978     1979     1978     1979     1978     1979
NUMBER(%)     5.88     8.50      0.0      0.0    22.34    23.67    71.78    67.82
MEAN (%)     29.07    24.20   ******   ******    66.67    66.67   100.00   100.00

            TABLES COMPARING 1978 AND 1979 MEAN SCORES AND PROPORTIONS
   ___PROPORTION TEST___ #  ____________________F-TEST______________________
   HO: PROPOR78=PROPOR79 #  _________SS________  _______DF______
   _T-CALC    DF    PROB #  BETWEEN     WITHIN   BETWEEN WITHIN  F-RATIO  PROB
A:  -3.213  3970   0.002 #  1645.66   50194.37      1      280    9.180   0.003
B:   0.0    3970   1.000 # <<<<<<<< TOO FEW PUPILS FOR CALCULATIONS >>>>>>>>
C:  -0.994  3970   0.320 # <<<<<<<<<<<<< SSW IS EQUAL TO ZERO >>>>>>>>>>>>>>
D:   2.712  3970   0.007 # <<<<<<<<<<<<< SSW IS EQUAL TO ZERO >>>>>>>>>>>>>>

     _____COMPARING THE MEAN SCORES OF PUPILS WITHIN ZONE SUBGROUPS______
                                 ____________________F-TEST TABLE_____________ ___
GFOUPS          YEARS        #  _________SS________  _______DF______
======       1978     1979   #  DETWEEN     WITHIN   BETWEEN WITHIN  F-RATIO  PROB
EAPLY        86.69    87.39  #   1033.13 1122821.71     1      2478    2.280  0.131
LATE         88.07    83.59  #   6502.62  683533.22     1      1300   12.367  0.001
MALE         88.44    85.77  #   3678.91 1028825.91     1      2074    7.416  0.007
FEMALE       88.32    85.55  #   3636.13  899162.16     1      1894    7.659  0.006
NORTH        86.67    89.88  #   2750.13  431648.88     1      1074    6.843  0.009
SOUTH        89.05    84.18  #  17133.80 1482356.30     1      2894   33.450  0.000
PUBLIC       87.55    85.81  #   2382.15 1588881.98     1      3164    4.744  0.030
SEPARATE     91.83    85.11  #   9090.81  332912.22     1       804   21.985  0.000
```

FIGURE 17

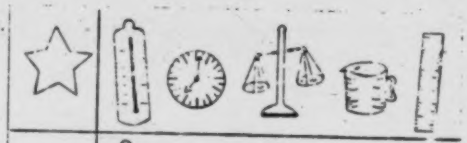
LEVEL A (Grade 1)

MEASUREMENT

OBJECTIVE 5 *Identifies instruments for measuring time, mass, length, capacity and temperature.*

TEST ITEMS

6.



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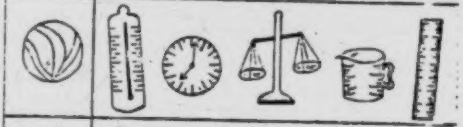

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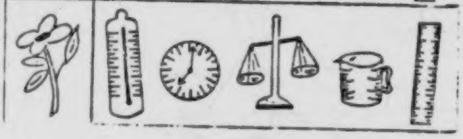

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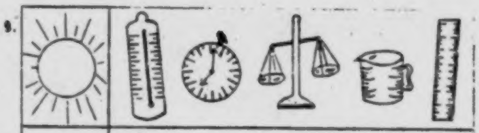

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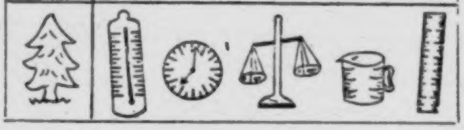

ANALYSIS

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_ZONE ONE__PUPILS_IN_1978_AND_1979_ACHIEVING_WITHIN_EACH_CATAGORY_A-D_
     CRITERION CATEGORIES FOR    GRADE:1   STRAND:3   OBJECTIVE: 5
          TOTAL NUMBER OF PUPILS:  1978 N=2126    1979 N=1846

           A: BELOW 50%       B:  50-64%        C:  65-84%        D: 85-100%
       ____1978____1979_____1978___1979_____1978___1979______1978___1979_
NUMBER(%)   2.49    3.68     5.79    6.01    16.56   14.08    75.16   76.22
MEAN (%)   23.77   15.88    60.00   60.00    80.00   80.00   100.00  100.00

          TABLES COMPARING 1978 AND 1979 MEAN SCORES AND PROPORTIONS
   ___PROPORTION TEST___ #  ____________________F-TEST____________________
   HO: PROPOR78=PROPOR79 #  _________SS________  ______DF______
   _T-CALC___DF_____PROB_#_BETWEEN_____WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
A:   -2.178  3970   0.030 #  1854.77   42892.34     1       119     5.146  0.025
B:   -0.304  3970   0.761 #    -0.00       0.00     1       232    -0.400  1.000
C:    2.153  3970   0.031 # <<<<<<<<<<<<<< SSW IS EQUAL TO ZERO >>>>>>>>>>>>>>
D:   -0.772  3970   0.440 # <<<<<<<<<<<<<< SSW IS EQUAL TO ZERO >>>>>>>>>>>>>>


   ______COMPARING_THE_MEAN_SCORES_OF_PUPILS_WITHIN_ZONE_SUBGROUPS_______
                            ___________________F-TEST TABLE_________________
GROUPS       YEARS       #  _________SS________  ______DF______
======______1978____1979__#__BETWEEN_____WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
EARLY        92.96   92.03 #   526.08  718771.34    1      2478    1.814   0.178
LATE         91.54   90.76 #   199.31  426579.18    1      1300    0.607   0.436
MALE         91.76   90.76 #   512.70  695627.57    1      2074    1.529   0.217
FEMALE       93.25   92.70 #   141.63  504442.33    1      1894    0.532   0.466
NORTH        92.40   91.35 #   294.37  298484.81    1      1074    1.059   0.304
SOUTH        92.50   91.79 #   360.46  904421.31    1      2894    1.153   0.283
PUBLIC       93.08   92.15 #   682.45  915230.76    1      3164    2.359   0.125
SEPARATE     89.95   89.95 #     0.00  282998.01    1       804    0.000   0.999
```

FIGURE 18

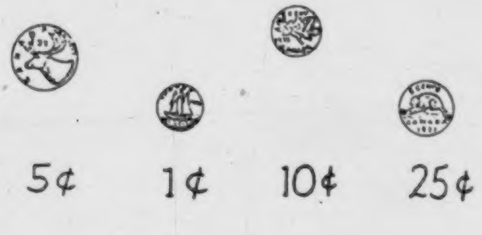
LEVEL A (Grade 1)

MEASUREMENT

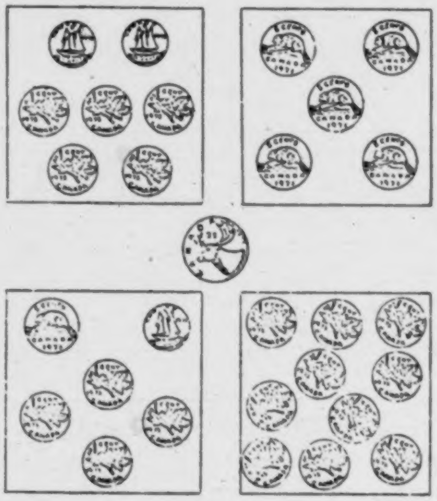
OBJECTIVE 6 *Recognizes pennies, nickles, dimes and quarters, and the value of each.*

TEST ITEMS

12.



13.



ANALYSIS

```
 _ZONE CNE__PUPILS_IN_1978_AND_1979_ACHIEVING_WITHIN_EACH_CATAGORY_A-D_
     CRITERION CATEGORIES FOR     GRADE:1   STRAND:3   OBJECTIVE: 6
           TOTAL NUMBER OF PUPILS:  1978 N=2126    1979 N=1846

           A: BELOW 50%       B:  50-64%        C:  65-84%        D: 85-100%
       ____1978____1979_____1978___1979_____1978___1979______1978____1979_
NUMBER(%)  30.76    27.68      0.0     0.0     24.98   28.60     44.26   43.72
MEAN (%)   25.64    25.44   ******  ******     66.67   66.67    100.00  100.00

            TABLES COMPARING 1978 AND 1979 MEAN SCORES AND PROPORTIONS
   ___PROPORTION TEST___ #  ____________________F-TEST____________________
   HO: PROPOR78=PROPOR79 #  ________SS_________  ______DF______
   _T-CALC___DF____PROB_#_ BETWEEN______WITHIN_BETWEEN_WITHIN__F-RATIO__PROB
A:   2.127   3970   0.033 #     11.11  231649.36    1       1163    0.056   0.813
B:   0.0     3970   1.000 #  <<<<<<<< TOO FEW PUPILS FOR CALCULATIONS >>>>>>>>
C:  -2.578   3970   0.010 #  <<<<<<<<<<<<< SSW IS EQUAL TO ZERO >>>>>>>>>>>>>
D:   0.345   3970   0.730 #  <<<<<<<<<<<<< SSW IS EQUAL TO ZERO >>>>>>>>>>>>>


   _______COMPARING_THE_MEAN_SCORES_OF_PUPILS_WITHIN_ZONE_SUBGROUPS______
                            ____________________F-TEST TABLE__________________
GROUPS         YEARS      #  _________SS_________  ______DF______
======_____1978____1979__#_BETWEEN_____WITHIN_BETWEEN_WITHIN__F-RATIO__PROB
EARLY       70.29   71.06 #    370.63 2498152.67    1       2478    0.368   0.544
LATE        64.97   68.12 #   3213.81 1387811.96    1       1300    3.010   0.083
MALE        70.77   71.30 #    141.58 2146107.09    1       2074    0.137   0.712
FEMALE      66.67   68.19 #   1096.42 1955743.71    1       1894    1.062   0.303
NORTH       73.05   71.52 #    627.16 1106634.30    1       1074    0.609   0.436
SOUTH       67.15   69.23 #   3137.39 2991785.49    1       2894    3.035   0.082
PUBLIC      68.81   70.55 #   2381.20 3280300.42    1       3164    2.297   0.130
SEPARATE    68.77   67.17 #    512.97  831408.73    1        804    0.496   0.481
```

FIGURE 19

than, shorter than, etc. to the degree that about ninety percent of them had achievement figures in the 85-100 percent category. They did somewhat poorer with estimating and measuring using non-standard units for capacity, mass and linear measures. Still ninety percent of the pupils were able to correctly answer two of the three items for this objective in both years.

About seventy-five percent of the pupils in 1978 and 1979 could identify the instruments for measuring time, mass, length, capacity and temperature to 85-100 percent level.

The grade one pupils do experience some difficulty with the value of pennies, nickles, dimes and quarters in collections up to twenty-five cents. Mean scores for the sub-groups ranged from 67 to 71 percent with forty-four percent of the pupils scoring 100 percent.

Geometry (two objectives; Figures 20 and 21)

Hypothesis 1

One objective had achievement performances where eighty percent of the Zone One pupils were in the 85-100 percent range for both 1978 and 1979.

Hypothesis 2

Neither objective had significant increases in the proportion of pupils achieving to the 85-100 percent criterion from 1978 to 1979.

Findings

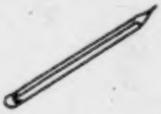
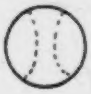
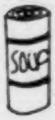
LEVEL A (Grade 1)

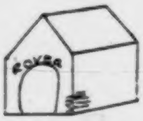
GEOMETRY

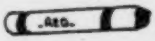
OBJECTIVE 1 *Classifies, by manipulation, 3-dimensional objects according to various attributes.*

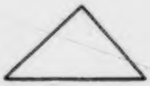
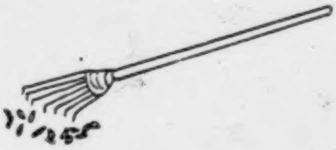
TEST ITEMS

14. Which objects can roll? Mark these with an X.





ANALYSIS

```
 ZONE ONE  PUPILS IN 1978 AND 1979 ACHIEVING WITHIN EACH CATAGORY A-D
     CRITERION CATEGORIES FOR    GRADE:1   STRAND:4   OBJECTIVE: 1
          TOTAL NUMBER OF PUPILS:  1978 N=2126   1979 N=1846

           A: BELOW 50%      B:  50-64%        C:  65-84%        D: 85-100%
        ____1978____1979_____1978____1979_____1978____1979______1978____1979_
NUMBEF(%)   3.67     4.77     2.35     1.73     8.47     7.80     85.51   85.70
MEAN (%)   13.46    11.08    50.00    50.00    75.00    75.00    100.00  100.00

          TABLES COMPARING 1978 AND 1979 MEAN SCORES AND PROPORTIONS
   ___PFOPORTION TEST___ #  __________________F-TEST______________________
   HO: PROPOR78=PROPOR79 #  ________SS________   ______DF______
   _T-CALC___DF____PROB_#__BETWEEN_____WITHIN__BETWEEN WITHIN__F-RATIO__PROB
A:  -1.725   3970   0.085 #   234.61   25687.83    1      164     1.498   0.223
B:   1.367   3970   0.172 #  <<<<<<<<<<<<< SSW IS EQUAL TO ZERO >>>>>>>>>>>>>>
C:   0.765   3970   0.445 #  <<<<<<<<<<<<< SSW IS EQUAL TO ZERO >>>>>>>>>>>>>>
D:  -0.167   3970   0.868 #  <<<<<<<<<<<<< SSW IS EQUAL TO ZERO >>>>>>>>>>>>>>

   _____COMPARING THE MEAN SCORES OF PUPILS WITHIN ZONE SUBGROUPS _____
                            __________________F-TEST TABLE__________________
GROUPS       YEARS      #  ________SS________   ______DF______
======_____1978____1979_#_BETWEEN_____WITHIN__BETWEEN WITHIN__F-RATIO__PROB
EAFLY      93.73   93.08 #    258.80  948858.13    1      2478    0.676   0.411
LATE       92.86   92.56 #     27.95  526644.96    1      1300    0.069   0.793
MALE       93.95   92.90 #    572.68  785035.16    1      2074    1.513   0.219
FEMALE     93.08   92.99 #      3.43  746847.84    1      1894    0.009   0.926
NORTH      93.82   93.97 #      5.78  380442.06    1      1074    0.016   0.898
SOUTH      93.42   92.58 #    505.44 1161096.77    1      2894    1.271   0.260
PUBLIC     93.84   93.60 #     49.04 1135496.60    1      3164    0.137   0.712
SEPARATE   92.23   90.55 #    873.40  393053.31    1       804    1.173   0.279
```

FIGURE 20

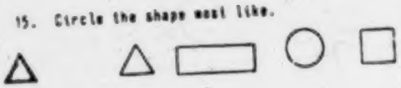
LEVEL A (Grade 1)

GEOMETRY

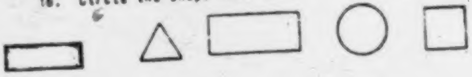
OBJECTIVE 2 *Recognizes and names: circle, square, triangle, rectangle.*

TEST ITEMS

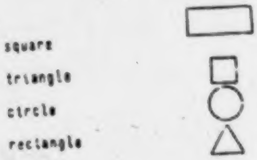
15. Circle the shape most like.



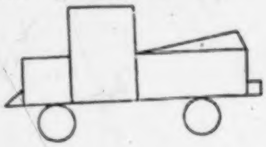
16. Circle the shape most like.



17\.



19. 1. Color all the squares blue.
2. Color all the circles yellow.
3. Color all the triangles red.
4. Color all the rectangles green.



ANALYSIS

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_ZONE ONE__PUPILS_IN_1978_AND_1979_ACHIEVING_WITHIN_EACH_CATAGORY_A-D_
     CRITERION CATEGORIES FOR    GRADE:1   STRAND:4   OBJECTIVE: 2
          TOTAL NUMBER OF PUPILS:  1978 N=2126    1979 N=1846

                                                                D: 85-100%
                                                  C:  65-84%   _1978___1979_
          A: BELOW 50%        B:  50-64%        _1978___1979__   67.40   68.09
       ____1978____1979_____1978____1979_____   19.85   19.18  100.00  100.00
NUMBER(%)   3.48    3.68     9.27    9.05       75.00   75.00
MEAN (%)   15.54    8.09    50.00   50.00
          TABLES COMPARING 1978 AND 1979 MEAN SCORES AND PROPORTIONS
                            ____________________F-TEST_______________________
   ___PROPORTION TEST___ #  _________________________DF______
   HO: PROPOR78=PROPOR79 #  ________SS__ ____   _______________  F-RATIO  PROB
   _T-CALC___DF____PROB_#__BETWEEN_____WITHIN__BETWEEN WITHIN   13.653   0.000
A:  -0.344  3970   0.731 #   1968.04   20179.85     1      140  >>>>>>>>>>>>>>>
B:   0.239  3970   0.811 #  <<<<<<<<<<<<<< SSW IS EQUAL TO ZERO >>>>>>>>>>>>>>>
C:   0.533  3970   0.594 #  <<<<<<<<<<<<<< SSW IS EQUAL TO ZERO >>>>>>>>>>>>>>>
D:  -0.464  3970   0.643 #  <<<<<<<<<<<<<< SSW IS EQUAL TO ZERO

              _____COMPARING_THE_MEAN_SCORES_OF_PUPILS_WITHIN_ZONE_SUBGROUPS_____
  -_________________________________________F-TEST TABLE__________________
                              ____________________   _______DF______
                  YEARS        #  _________SS_________                F-RATIO  PROB
GROUPS                            BETWEEN_____WITHIN  BETWEEN WITHIN   0.790   0.374
======_____1978____1979_#__       361.72 1134573.76      1      2478   1.195   0.275
EARLY       88.01   87.25 #       607.81  661424.16      1      1300   0.096   0.757
LATE        86.53   87.90 #        47.47 1028298.81      1      2074   0.000   0.992
MALE        86.59   86.29 #         0.05  853430.53      1      1894   2.593   0.108
FEMALE      88.41   88.42 #      1172.16  485421.71      1      1074   1.548   0.214
NORTH       86.05   88.15 #       747.88 1397998.67      1      2894   0.000   0.997
SOUTH       88.01   87.00 #         0.01 1502091.95      1      3164   0.194   0.660
PUBLIC      87.65   87.67 #        92.06  382104.74      1       804
SEPARATE    86.59   85.91 #
```

FIGURE 21

The pupils experienced success with the classifying of 3-dimensional objectives according to shape attributes. Performances were such that over eighty-five percent of the grade ones in the zone reached category D (85-100 percent).

Over eighty-five percent of the pupils could also recognize and name the circle, square, triangle and rectangle in three of the four items related to such terminology but only about two-thirds achieved to the 85 percent level.

Graphing (One objective; figure 22)

Hypothesis 1

The one graphing objective did not have an eighty percent proportion of students achieving within category D (85-100 percent) for either 1978 or 1979.

Hypothesis 2

The proportions of pupils achieving to the 85-100 percent level on the one objective did not increase significantly in 1979 over the 1978 testing.

Findings

Over seventy percent of the pupils in 1978 and 1979 were able to construct graphs using pictures and objects to achievement levels C and D (65-100 percent). At the same time about twenty percent of the pupils could not construct a graph with any degree of accuracy.

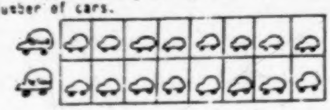
LEVEL A (Grade 1)

GRAPHING

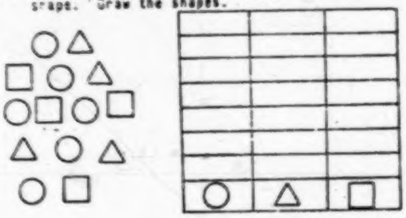
OBJECTIVE 1 *Collects data from immediate environment and constructs graphs using pictures or objects.*

TEST ITEMS

19. Some boys have 6 blue cars and 3 yellow cars. Show this on the graph by coloring the correct number of cars.



20. Make a graph showing the correct number of each shape. Draw the shapes.



ANALYSIS

```
 ZONE ONE  PUPILS IN 1978 AND 1979 ACHIEVING WITHIN EACH CATAGORY A-D
     CRITERION CATEGORIES FOR     GRADE:1   STRAND:5   OBJECTIVE: 1
            TOTAL NUMBER OF PUPILS:  1978 N=2126   1979 N=1846

            A: BELOW 50%        B:  50-64%        C:  65-84%         D: 85-100%
           1978     1979      1978    1979      1978    1979      1978     1979
NUMBER(%)  21.64    18.91     7.53    8.88     15.90   15.82     54.94    56.39
MEAN (%)   29.65    27.05    60.00   60.00     80.00   80.00    100.00   100.00

           TABLES COMPARING 1978 AND 1979 MEAN SCORES AND PROPORTIONS
   ___PROPORTION TEST___ #  ___________________F-TEST_______________________
   HO: PROPOR78=PROPOR79 #  ________SS_________  ______DF______
    T-CALC    DF    PROB #  BETWEEN      WITHIN  BETWEEN WITHIN  F-RATIO  PROB
A:   2.132  3970   0.033 #  1345.05   229004.52     1      807     4.740  0.030
B:  -1.560  3970   0.119 #     0.00        0.00     1      322     7.667  0.006
C:   0.069  3970   0.945 #  <<<<<<<<<<<<<< SSW IS EQUAL TO ZERO >>>>>>>>>>>>>>
D:  -0.919  3970   0.358 #  <<<<<<<<<<<<<< SSW IS EQUAL TO ZERO >>>>>>>>>>>>>>


  ______COMPARING THE MEAN SCORES OF PUPILS WITHIN ZONE SUBGROUPS ______
                            ___________________F-TEST TABLE_________________
GROUPS        YEARS      #  ________SS_________  ______DF______
======      1978   1979  #  BETWEEN      WITHIN  BETWEEN WITHIN  F-RATIO  PROB
EARLY      79.19  80.31  #   777.86  2013413.10     1     2478     0.957  0.328
LATE       77.57  77.21  #    41.20  1210784.30     1     1300     0.044  0.833
MALE       76.78  77.94  #   703.99  1827605.06     1     2074     0.799  0.372
FEMALE     80.55  81.21  #   208.26  1542007.57     1     1894     0.256  0.613
NORTH      79.36  81.58  #  1309.32   867756.48     1     1074     1.621  0.203
SOUTH      78.29  78.75  #   156.62  2510999.18     1     2894     0.181  0.671
PUBLIC     78.30  78.51  #    36.68  2774212.21     1     3164     0.042  0.838
SEPARATE   79.81  83.10  #  2180.79   600606.80     1      804     2.919  0.088
```

FIGURE 22

A. DISCUSSION OF THE GRADE ONE RESULTS

The achievement picture for grade one, given in Tables 5, 6 and 7 is good.

There are however indications that problems may be forthcoming within at least three of the strands. Discussion of these and subsequent factors will be handled within the context of the five strands of each grade level.

Number

Although over ninety percent of the pupils reached categories C and D on the overall number strand achievement, the one-quarter group that fail on the place value objective is cause for some concern.

Operations and Properties

The relatively high performance on the basic fact items is surprising when compared to the lower scores on symbolizing addition and subtraction situations (Figure 12). Although grade one pupils seem to understand the actions associated with addition and subtraction, they may require more discussion and activity to enable a better linking of the numerals with the operation symbols.

Measurement

The performance on grade one measurement items was generally strong. Certainly the objectives appear to be within the ability range of children entering school.

Question 13 in Figure 14, one of the items used to determine the ability of pupils to recognize coins and their values, goes beyond the grade one objective. The lower

TABLE 5
PERCENTAGE MEANS FOR GRADE ONE STUDENTS IN ZONE ONE FOR 1978 AND 1979

ZONE ONE GRADE ONE JUNE/78

	NUMBER	OPERATIONS & PROPERTIES	MEASUREMENT	GEOMETRY	GRAPHING
	1 92.9%	1 91.6%	1 90.9%	1 93.5%	1 78.6%
	2 89.7%	2 73.9%	2 69.9%	2 87.5%	
	3 98.3%	3 87.7%	3 95.6%		
	4 89.3%		4 88.4%		
	5 72.7%		5 92.5%		
			6 68.8%		
AVG	88.6%	84.4%	84.3%	90.5%	78.6%

ZONE ONE GRADE ONE JUNE/79

	NUMBER	OPERATIONS & PROPERTIES	MEASUREMENT	GEOMETRY	GRAPHING
	1 92.0%	1 92.2%	1 90.7%	1 92.9%	1 79.5%
	2 89.2%	2 76.5%	2 71.2%	2 87.3%	
	3 97.7%	3 87.1%	3 95.1%		
	4 89.1%		4 85.7%		
	5 76.3%		5 91.7%		
			6 69.8%		
AVG	88.9%	85.3%	84.0%	90.1%	79.5%

scores for this objective may be attributed to the forming combinations of coins requirement which is actually a level two requirement.

The fact that one-third of the pupils had difficulty with reciting the days of the week in order (recall) may be an indication that this skill is taken for granted by teachers.

TABLE 6

ACHIEVEMENT MEANS IN 1978 AND 1979 WITHIN CATEGORIES A-D FOR THE NUMBER, OPERATIONS AND PROPERTIES, AND MEASUREMENT STRANDS

```
    _ZONE ONE  PUPILS IN 1978 AND 1979 ACHIEVING WITHIN EACH CATAGORY A-D_
        CRITERION CATEGORIES FOR  GRADE:1  STRAND: NUMBER
             TOTAL NUMBER OF PUPILS:  1978 N=2126   1979 N=1846

             A: BELOW 50%      B:  50-64%        C:  65-84%        D: 85-100%
         ____1978____1979____1978____1979_____1978____1979_____1978____1979_
NUMBER(%)    1.83    1.79      4.47    4.28     23.10   22.32     70.60   71.61
MEAN (%)    33.46   28.46     59.01   58.54     76.72   76.62     95.78   95.93

              TABLES COMPARING 1978 AND 1979 MEAN SCORES AND PROPORTIONS
   ___PROPORTION TEST___ #  _____________________F-TEST______________________
   HO: PRCPOR78=PROPOR79 #  ________SS________  _______DF______
   _T-CALC____DF____PROB_#__BETWEEN_____WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
A:   0.110  3970   0.912 #    446.46   23114.60     1       70    1.352  0.249
B:   0.290  3970   0.772 #      9.69    3038.49     1      172    0.548  0.460
C:   0.582  3970   0.560 #      2.41   27003.06     1      901    0.081  0.777
D:  -0.702  3970   0.483 #     16.25   65870.23     1     2821    0.696  0.404


    _ZONE ONE  PUPILS IN 1978 AND 1979 ACHIEVING WITHIN EACH CATAGORY A-D_
        CRITERION CATEGORIES FOR  GRADE:1  STRAND: OPERATIONS & PROPERTIES
             TOTAL NUMBER OF PUPILS:  1978 N=2126   1979 N=1846

             A: BELOW 50%      B:  50-64%        C:  65-84%        D: 85-100%
         ____1978____1979____1978____1979_____1978____1979_____1978____1979_
NUMBER(%)    7.20    5.42      5.55    6.34     23.71   22.05     63.55   66.20
MEAN (%)    32.00   32.00     57.84   57.00     76.43   76.15     95.65   95.40

              TABLES COMPARING 1978 AND 1979 MEAN SCORES AND PROPORTIONS
   ___PROPORTION TEST___ #  _____________________F-TEST______________________
   HO: PRCPOR78=PROPOR79 #  ________SS________  _______DF______
   _T-CALC____DF____PROB_#__BETWEEN_____WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
A:   2.290  3970   0.022 #      0.00   46792.66     1      251    0.000  0.998
B:  -1.049  3970   0.294 #     40.52    4030.95     1      233    2.337  0.128
C:   1.240  3970   0.215 #     17.72   29885.32     1      909    0.539  0.463
D:  -1.744  3970   0.081 #     37.59   71243.41     1     2571    1.356  0.245


    _ZONE ONE  PUPILS IN 1978 AND 1979 ACHIEVING WITHIN EACH CATAGORY A-D_
        CRITERION CATEGORIES FOR  GRADE:1  STRAND: MEASUREMENT
             TOTAL NUMBER OF PUPILS:  1978 N=2126   1979 N=1846

             A: BELOW 50%      B:  50-64%        C:  65-84%        D: 85-100%
         ____1979____1979____1978____1979_____1978____1979_____1978____1979_
NUMBER(%)    3.20    4.23      7.38    7.04     31.84   29.79     57.57   58.94
MEAN (%)    35.17   26.23     58.85   59.16     76.26   76.26     94.80   95.08

              TABLES COMPARING 1978 AND 1979 MEAN SCORES AND PROPORTIONS
   ___PROPORTION TEST___ #  _____________________F-TEST______________________
   HO: PRCPOR78=PROPOR79 #  ________SS________  _______DF______
   _T-CALC____DF____PROB_#__BETWEEN_____WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
A:  -1.715  3970   0.087 #   2903.12   46228.95     1      144    9.043  0.003
B:   0.416  3970   0.678 #      6.79    4216.00     1      285    0.459  0.499
C:   1.394  3970   0.164 #      0.00   40657.74     1     1225    0.000  0.994
D:  -0.870  3970   0.384 #     46.22   53002.42     1     2310    2.015  0.156
```

TABLE 7

ACHIEVEMENT MEANS IN 1978 AND 1979 WITHIN CATEGORIES A-D FOR THE GEOMETRY AND GRAPHING STRANDS

```
    _ZONE_ONE__PUPILS_IN_1978_AND_1979_ACHIEVING_WITHIN_EACH_CATAGORY_A-D_
        CRITERION CATEGORIES FOR  GRADE:1  STRAND: GEOMETRY
              TOTAL NUMBER OF PUPILS:  1978 N=2126    1979 N=1846

              A: BELOW 50%       B:  50-64%        C:  65-84%        D: 85-100%
          ____1978____1979____1978____1979_____1978____1979_____1978____1979_
NUMBER(%)   2.02      2.65     6.16     5.58    10.21     9.64    81.61   82.12
MEAN (%)   22.67     11.48    57.92    58.74    75.00    75.00    96.58   96.57

               TABLES COMPARING 1978 AND 1979 MEAN SCORES AND PROPORTIONS
    ___PROPORTION TEST___ #  ____________________F-TEST______________________
    HO: PRCPOR78=PROPOR79 #  ________SS________  ______DF______
    _T-CALC___DF____PROB_#__BETWEEN_____WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
A:   -1.320  3970   0.187 #   2870.20   24403.92    1        90   10.585  0.002
B:    0.777  3970   0.437 #     38.58    8137.63    1       232    1.100  0.295
C:    0.593  3970   0.553 #  <<<<<<<<<<<<<< SSW IS EQUAL TO ZERO >>>>>>>>>>>>>>
D:   -0.420  3970   0.675 #      0.05  101063.08    1      3249    0.002  0.968


    _ZONE_ONE__PUPILS_IN_1978_AND_1979_ACHIEVING_WITHIN_EACH_CATAGORY_A-D_
        CRITERION CATEGORIES FOR  GRADE:1  STRAND: GRAPHING
              TOTAL NUMBER OF PUPILS:  1978 N=2126    1979 N=1846

              A: BELOW 50%       B:  50-64%        C:  65-84%        D: 85-100%
          ____1978____1979____1978____1979_____1978____1979_____1978____1979_
NUMBER(%)  21.64     18.91     7.53     3.88    15.90    15.82    54.94   56.39
MEAN (%)   29.65     27.05    60.00    60.00    80.00    80.00   100.00  100.00

               TABLES COMPARING 1978 AND 1979 MEAN SCORES AND PROPORTIONS
    ___PROPORTION TEST___ #  ____________________F-TEST______________________
    HO: PRCPOR78=PROPOR79 #  ________SS________  ______DF______
    _T-CALC___DF____PROB_#__BETWEEN_____WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
A:    2.132  3970   0.033 #   1345.05  229004.52    1       807    4.740  0.030
B:   -1.560  3970   0.119 #      0.00       0.00    1       322    4.411  0.037
C:    0.069  3970   0.945 #      0.0        0.00    1       628    0.0    1.000
D:   -0.919  3970   0.358 #  <<<<<<<<<<<<<< SSW IS EQUAL TO ZERO >>>>>>>>>>>>>>
```

Geometry

The high achievement mean scores on the two geometry objectives certainly indicates thay they are within the range of at least ninety-five percent of the pupils at the grade one level. The knowledge being measured by the items however may be more of an indication of that which is acquired out of school than of the instructional treatment of geometry.

Graphing

Since achievement was high on the prerequisite skills of matching and cardinality it seems that the format and structure of graphs is unfamiliar to grade one pupils.

CHAPTER V

GRADE TWO

ANALYSIS OF HYPOTHESIS ONE AND TWO FOR GRADE TWO

NOTE: For a description of the figures used in the following analysis see Chapter IV.

NUMBER (Seven objectives; Figure 24 to 50).

Hypothesis 1

Three objective had performances where eighty percent of the Zone One pupils in 1978 and 1979 were within the 85-100 percent catagory.

Hypothesis 2

Three objectives had significant increases in the proportion of pupils achieving to the 85-100 percent level in 1979.

Findings

The grade two pupils demonstrated an understanding of cardinal number (eg. associating a numeral with a set of objects). Over eighty percent of Zone One pupils combined to form a mean score of 99 percent. Even higher achievement levels were found for ordering numerals and recognizing "betweeness".

Some difficulties are beginning to emerge in the important place value concepts. While about three-quarters of the pupils could read and write numerals (0-999) to the

QUESTION	STRAND	OBJECTIVE	RAW SCORE VALUE	% VALUE
1	Number	7	4	1
2	Number	3	4	1
3	Number	4	12	3
4	Number	4	12	3
5	Number	3	4	1
6	Number	7	4	1
7	Number	5	4	1
8	Number	5	4	1
9	Number	5	4	1
10	Number	3	4	1
11	Number	3	4	1
12	Number	3	4	1
13	Number	3	4	1
14	Operations & Properties	4	9	8
15	Operations & Properties	4	10	
16	Operations & Properties	4	13	
17	Number	1	12	3
18	Number	2	20	5
19	Number	1	12	3
20	Number	7	8	2
21	Number	5	12	3
22	Number	6	28	7
23	Operations & Properties	2	4	1
24	Operations & Properties	1	4	1
25	Operations & Properties	1	4	1
26	Operations & Properties	2	8	2
27	Operations & Properties	3	4	1
28	Operations & Properties	3	4	1
29	Operations & Properties	3	4	1
30	Operations & Properties	5	8	2
31	Operations & Properties	5	8	2
32	Operations & Properties	5	8	2
33	Operations & Properties	6	32	8

- PART I -

QUESTION	STRAND	OBJECTIVE	RAW SCORE VALUE	% VALUE
1	Measurement	5	1	¼
2	Measurement	5	1	¼
3	Measurement	5	1	¼
4	Measurement	5	1	¼
5	Measurement	5	1	¼
6	Measurement	5	1	¼
7	Measurement	5	1	¼
8	Measurement	5	1	¼
9	Measurement	1 & 2	2	½
10	Measurement	1 & 2	2	½
11	Measurement	3	4	1
12	Measurement	6	12	3
13	Measurement	7	2	½
14	Measurement	7	2	½
15	Measurement	10	2	½
16	Measurement	10	2	½
17	Measurement	8	2	½
18	Measurement	8	2	½
19	Measurement	9	4	1
20	Measurement	9	4	1
21	Measurement	9	4	1
22	Geometry	1 & 2	16	4
23	Geometry	3	4	1
24	Geometry	3	4	1
25	Geometry	3	4	1
26	Graphing	1	12	3
27	Graphing	2	20	5
28	Measurement	4	4	1
29	Measurement	5	2	½
30	Measurement	5	2	½
		TOTALS:	120	30

- PART II -

FIGURE 23

GRADE TWO DETAILED ANALYSIS OF MARK WEIGHTINGS

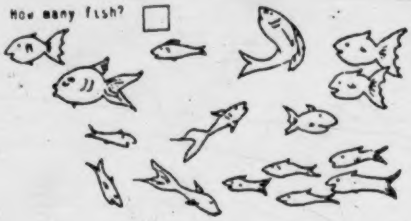
LEVEL B (Grade 2)

NUMBER

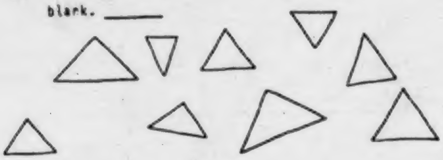
OBJECTIVE 1 *Identifies the cardinal number associated with a set of objects.*

TEST ITEMS

17. How many fish? ☐



19. How many triangles? Write the number on this blank. ______



ANALYSIS

```
ZONE ONE  PUPILS IN 1978 AND 1979 ACHIEVING WITHIN EACH CATAGORY A-D
     CRITERION CATEGORIES FOR     GRADE:2   STRAND:1   OBJECTIVE: 1
          TOTAL NUMBER OF PUPILS:   1978 N=2303    1979 N=2070

              A: BELOW 50%       B:  50-64%        C:  65-84%        D: 85-100%
            ____1978____1979_____1978____1979_____1978____1979_____1978____1979_
NUMBER(%)     1.61      2.66     13.33    13.62      0.13     0.29    84.93    83.43
MEAN (%)      2.03      6.14     50.00    50.18     72.22    75.00    99.95    99.94

           TABLES COMPARING 1978 AND 1979 MEAN SCORES AND PROPORTIONS
   ___PROPORTION TEST___ #  _____________________F-TEST_______________________
   HO: PROPOR78=PROPOR79 #  ________SS________  ______DF______
   _T-CALC____DF____PROB_#__BETWEEN______WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
A:   -2.417   4371   0.016 #    373.53     9669.31     1        50     3.477   0.066
B:   -0.283   4371   0.777 #      4.62      373.08     1       587     7.270   0.007
C:   -1.163   4371   0.245 #     15.43      462.96     1         7     0.233   0.644
D:    1.361   4371   0.174 #      0.12     2280.69     1      3681     0.190   0.663

      ______COMPARING THE MEAN SCORES OF PUPILS WITHIN ZONE SUBGROUPS_______
   ______________________________________F-TEST TABLE________________________
                                   ____________________
                             #   ________SS________  ______DF______
GROUPS          YEARS        #   BETWEEN______WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
======_____1978_____1979__#__
EARLY       91.67    90.77 #    563.86  1253316.04     1      2788    1.254   0.263
LATE        91.61    90.11 #    781.04   653010.23     1      1359    1.673   0.196
MALE        90.29    89.25 #    600.17  1147949.78     1      2232    1.167   0.280
FEMALE      93.15    91.99 #    713.34   827189.12     1      2137    1.843   0.175
NORTH       91.25    90.78 #     84.89   728118.22     1      1518    0.177   0.674
SOUTH       91.93    90.51 #   1444.72  1255320.96     1      2851    3.281   0.070
PUBLIC      91.90    90.52 #   1727.81  1604614.39     1      3611    3.888   0.049
SEPARATE    90.53    90.95 #     24.21   378493.33     1       788    0.048   0.826
```

FIGURE 24

LEVEL B (Grade 2)

NUMBER

OBJECTIVE 2 *Orders numerals and recognizes "betweenness." (0-100)*

TEST ITEMS

18. Which number is missing? Write it in the blank.

12, 13, _____, 15

48, 49, 50, _____

_____, 65, 67, 69

29, _____, 31, 32

_____, 108, 109, 110

ANALYSIS

```
 _ZONE_ONE__PUPILS_IN_1978_AND_1979_ACHIEVING_WITHIN_EACH_CATAGORY_A-D_
      CRITERION CATEGORIES FOR     GRADE:2    STRAND:1    OBJECTIVE: 2
             TOTAL NUMBER OF PUPILS:   1978 N=2303    1979 N=2070

            A: BELOW 50%        B:  50-64%         C:  65-84%         D: 85-100%
         ____1978____1979_____1978____1979______1978____1979_____1978____1979_
NUMBER(%)    2.30     3.09      1.82     2.03      8.68     7.15     87.19   87.73
MEAN (%)    12.92    13.36     59.52    59.05     79.97    79.93     99.99   99.99

            TABLES COMPARING 1978 AND 1979 MEAN SCORES AND PROPORTIONS
   ___PROPORTION TEST___ #   ____________________F-TEST_______________________
   HO: PROPOR78=PROPOR79 #   _________SS________  ______DF______
   _T-CALC____DF____PROB_#__BETWEEN_____WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
A:  -1.617   4371   0.106 #        5.48   26474.43     1         115     0.024   0.878
B:  -0.494   4371   0.622 #        4.76     552.38     1          62     0.707   0.403
C:   1.872   4371   0.061 #        0.15      74.20     1         346     0.719   0.397
D:  -0.537   4371   0.592 #        0.00     324.68     1        3822     0.032   0.857

   ______COMPARING_THE_MEAN_SCORES_OF_PUPILS_WITHIN_ZONE_SUBGROUPS_______
                             ____________________F-TEST TABLE__________________
GROUPS          YEARS       #   _________SS________  ______DF______
======______1978____1979__#__BETWEEN______WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
EARLY          95.35    95.40 #       1.99   674310.34     1       2768     0.008   0.928
LATE           95.95    94.38 #     864.57   369033.40     1       1399     3.278   0.070
MALE           95.00    94.80 #      23.05   606883.14     1       2232     0.085   0.771
FEMALE         96.04    95.31 #     289.52   483936.45     1       2137     1.278   0.258
NORTH          93.43    93.57 #       7.68   562852.18     1       1518     0.021   0.886
SOUTH          96.71    95.77 #     633.19   520749.62     1       2851     3.467   0.063
PUBLIC         95.46    94.74 #     461.45   940661.18     1       3611     1.771   0.184
SEPARATE       95.77    96.48 #      87.41   149984.17     1        758     0.442   0.507
```

FIGURE 25

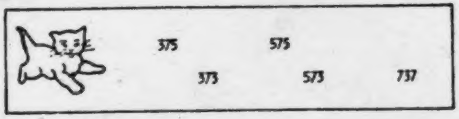
LEVEL B (Grade 2)

NUMBER

OBJECTIVE 3 *Reads and writes numerals.* (0-999)

TEST ITEMS

2.



2. Say, "In the next box, the one with the cat, find the numeral five hundred seventy three and draw a circle around it--draw a circle around five hundred seventy three."

5.

937 793 739
379 397

Say, "In box number 5, the first one at the top of the page, find the number seven hundred ninety three and draw a circle around it--draw a circle around seven hundred ninety three."

Say, "In the next box, box number 10, write the number forty-nine on the blank--write the number forty-nine on the blank in box 10."

10. ______

11. ______

12. ______

13. ______

ANALYSIS

```
 _ZONE_ONE__PUPILS_IN_1978_AND_1979_ACHIEVING_WITHIN_EACH_CATAGORY_A-D_
     CRITERION CATEGORIES FOR     GRADE:2   STRAND:1   OBJECTIVE: 3
          TOTAL NUMBER OF PUPILS:   1978 N=2303    1979 N=2070

          A: BELOW 50%       B:  50-64%        C:  65-84%        D: 85-100%
      ____1978____1979_____1978____1979______1978____1979______1978____1979_
NUMBER(%)   1.48     3.09      3.60     3.24     21.10    19.81    73.82    73.86
MEAN (%)   26.47    22.01     50.15    50.25     78.52    77.83    99.98    99.94

           TABLES COMPARING 1978 AND 1979 MEAN SCORES AND PROPORTIONS
  ___PROPORTION TEST___ #  ____________________F-TEST________________________
  HO: PRCPOR78=PROPOR79 #  _________SS________  ______DF______
  _T-CALC____DF____PROB_#__BETWEEN______WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
A:  -3.604  4371   0.000 #    442.74   12026.08     1         96    3.534  0.063
B:   0.666  4371   0.505 #      0.36     219.67     1        148    0.241  0.624
C:   1.060  4371   0.289 #    105.84   52632.25     1        894    1.798  0.180
D:  -0.036  4371   0.971 #      1.14    1157.53     1       3227    3.176  0.075

   ______COMPARING_THE_MEAN_SCORES_OF_PUPILS_WITHIN_ZONE_SUBGROUPS_______
                           ____________________F-TEST TABLE__________________
GROUPS         YEARS     #  _________SS________  ______DF______
======_____1978_____1979_#__BETWEEN______WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
EARLY        91.90    91.48 #    122.58  762928.77     1       2788    0.448  0.503
LATE         93.98    91.80 #   1661.99  349894.96     1       1399    6.645  0.010
MALE         92.21    91.94 #     41.02  593277.34     1       2232    0.154  0.695
FEMALE       92.95    91.14 #   1752.92  568125.30     1       2137    6.594  0.010
NORTH        89.32    87.56 #   1164.45  644269.40     1       1518    2.744  0.098
SOUTH        94.44    93.49 #    654.01  487692.77     1       2851    3.823  0.051
PUBLIC       92.53    91.03 #   2115.46 1020757.20     1       3611    7.484  0.006
SEPARATE     92.74    94.02 #    310.32  138501.36     1        758    1.698  0.193
```

FIGURE 26

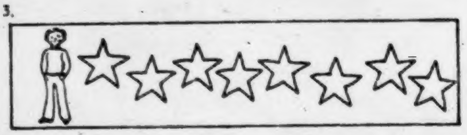
LEVEL B (Grade 2)

NUMBER

OBJECTIVE 4 *Names ordinals first to tenth.*

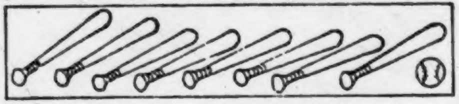
TEST ITEMS

3.



Say, "In the next box, the one with the boy in it, draw a circle around the eighth star from the boy--draw a circle around the eighth star from the boy."

4.



Say, "In the last box, the one with the ball and the bats, draw a circle around the fifth bat from the ball—draw a circle around the fifth bat from the ball."

ANALYSIS

```
 _ZONE_ONE__PUPILS_IN_1978_AND_1979_ACHIEVING_WITHIN_EACH_CATAGCRY_A-D_
    CRITERION CATEGORIES FOR     GRADE:2    STRAND:1    OBJECTIVE: 4
          TCTAL NUMBER OF PUPILS:  1978 N=2303    1979 N=2070

           A: BELOW 50%       B:  50-64%        C:  65-84%         D: 85-100%
      ____1978____1979_____1978____1979______1978____1979_____1978____1979_
NUMBER(%)   6.47    11.06     14.55   12.90      0.09    0.29    78.90   75.75
MEAN (%)    2.46    13.85     50.01   50.06     66.67   69.44   100.00   99.98

           TABLES CCMPARING 1978 AND 1979 MEAN SCORES AND PROPORTIONS
   ___PROPORTION TEST___ #  ____________________F-TEST______________________
   HO: PRCPOR78=PROPOR79 #  _________SS_________  ______DF______
    T-CALC____DF____PROB_#__BETWEEN______WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
A:  -5.397  4371   0.000 #  11701.47    59828.37    1        376   73.540  0.000
B:   1.579  4371   0.115 #      0.37      155.16    1        600    1.435  0.231
C:  -1.869  4371   0.117 #     11.57      231.48    1          6    0.300  0.604
D:   2.486  4371   0.013 #      0.31      363.65    1       3383    2.926  0.087


      _____COMPARING_THE_MEAN_SCORES_OF_PUPILS_WITHIN_ZONE_SUBGROUPS______
                            ____________________F-TEST TABLE_________________
GROUPS          YEARS      #  _________SS_________  ______DF______
======______1978____1979__#__BETWEEN______WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
EARLY        84.96   82.91 #   2910.48 2556166.39     1       2788    3.174  0.075
LATE         89.37   85.29 #   5808.89 1038328.51     1       1399    7.827  0.005
MALE         85.19   83.20 #   2192.00 2048878.23     1       2232    2.388  0.122
FEMALE       87.64   84.67 #   4732.23 1673136.87     1       2137    6.044  0.014
NORTH        79.86   76.94 #   3210.26 1822419.66     1       1518    2.674  0.102
SOUTH        90.15   87.32 #   5681.58 1798455.75     1       2851    9.007  0.003
PUBLIC       85.73   82.49 #   9471.35 3294305.62     1       3611   10.382  0.001
SEPARATE     89.60   90.46 #    137.92  408083.94     1        758    0.256  0.613
```

FIGURE 27

LEVEL B (Grade 2)

NUMBER

OBJECTIVE 5 *Identifies the number of 100's, 10's and 1's in a given three-digit numeral.*

TEST ITEMS

7. ______

Say, "Look at this flashcard (798). In box number 7 in the next row, write the number that shows how many hundreds there are in this number--write the number that shows how many hundreds. Write it on the blank."

8. ______

Say, "Look at this flashcard (401). In the next box, box number 8, write the number that shows how many ones there are in the number on the card. Write it on the blank--write the number that shows how many ones."

9. ______

Say, "Look at this flashcard (267). In the first box in the next row, number 9, write the number that shows how many tens there are in the number on the card. Write it on the blank--write the number that shows how many tens."

21. Fill in the blanks.

539 _____ tens _____ ones _____ hundreds

462 _____ ones _____ tens _____ hundreds

596 _____ hundreds _____ ones _____ tens

ANALYSIS

```
 _ZONE_ONE__PUPILS_IN_1978_AND_1979_ACHIEVING_WITHIN_EACH_CATAGORY_A-D_
      CRITERION CATEGORIES FOR     GRADE:2    STRAND:1    OBJECTIVE: 5
            TOTAL NUMBER OF PUPILS:  1978 N=2303    1979 N=2070

            A: BELOW 50%        B:  50-64%         C:  65-84%         D: 85-100%
        ____1978____1979_____1978____1979_____1978____1979_____1978____1979_
NUMBER(%)   28.53    26.81     14.59    13.33     17.24    16.57     39.64    43.29
MEAN (%)    17.62    19.48     50.04    50.68     76.36    76.57     99.96    99.93

             TABLES COMPARING 1978 AND 1979 MEAN SCORES AND PROPORTIONS
   ___PROPORTION TEST___ #  ____________________F-TEST______________________
   HO: PROPOR78=PROPOR79 #  ________SS________  ______DF______
   _T-CALC____DF____PROB_#_BETWEEN_____WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
A:    1.266  4371   0.206 #   1045.34  198704.43      1       1210    6.366  0.012
B:    1.196  4371   0.232 #     62.48    2163.82      1        610   17.615  0.000
C:    0.589  4371   0.556 #      7.56   49165.19      1        738    0.113  0.736
D:   -2.441  4371   0.015 #      0.50     948.36      1       1807    0.957  0.328


     ______COMPARING_THE_MEAN_SCORES_OF_PUPILS_WITHIN_ZONE_SUBGROUPS______
                               ____________________F-TEST TABLE_________________
GROUPS         YEARS       #  ________SS________  ______DF______
======______1978____1979__#__BETWEEN_____WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
EARLY         63.68   67.32 #   9165.19 3441855.75      1       2788    7.424  0.007
LATE          67.66   69.67 #   1417.15 1642628.35      1       1399    1.207  0.272
MALE          65.99   68.29 #   2943.01 2635535.02      1       2232    2.492  0.115
FEMALE        64.20   67.54 #   5939.03 2658246.09      1       2137    4.774  0.029
NORTH         60.08   64.23 #   6473.59 2026586.53      1       1516    4.849  0.028
SOUTH         68.02   69.72 #   2049.54 3221831.66      1       2851    1.814  0.179
PUBLIC        65.31   67.83 #   5699.37 4458500.93      1       3611    4.616  0.032
SEPARATE      64.15   68.34 #   3321.13  836913.13      1        758    3.008  0.083
```

FIGURE 28

LEVEL B (Grade 2)

NUMBER

OBJECTIVE 6 *Identifies multiples by counting by 5's, 10's and 100's.*

TEST ITEMS

22. Fill in the blanks.

Count by 5's

35, 40, _____, _____, _____, 60, _____, 70, _____

Count by 10's

_____, 20, _____, _____, 50, _____, _____

Count by 100's

0, _____, 200, _____, _____, _____, 600

ANALYSIS

```
  _ZONE_ONE__PUPILS_IN_1978_AND_1979_ACHIEVING_WITHIN_EACH_CATAGCRY_A-D_
      CRITERION CATEGORIES FOR    GRADE:2   STRAND:1   OBJECTIVE: 6
            TCTAL NUMBER OF PUPILS:  1978 N=2303    1979 N=2070

           A: BELOW 50%      B:  50-64%       C:  65-84%       D: 85-100%
         ____1978____1979_____1978____1979_____1978____1979_____1978____1979_
NUMBER(%)    6.34    5.65     4.69    3.53     3.08    2.42    85.89   88.41
MEAN (%)    15.61   16.82    62.70   61.35    74.25   74.50    99.07   99.24

            TABLES CCMPARING 1978 AND 1979 MEAN SCORES AND PROPORTIONS
   ___PROPORTION TEST___ #  ____________________F-TEST____________________
   HO: PRCPOR78=PROPOR79 #  ________SS________  ______DF______
   _T-CALC____DF____PROB_#__BETWEEN______WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
A:   0.958  4371   0.340 #    95.51    65333.51     1      261     0.382  0.537
B:   1.928  4371   0.054 #    79.16     3384.59     1      179     4.187  0.042
C:   1.344  4371   0.180 #     1.90     1528.71     1      119     0.148  0.701
D:  -2.478  4371   0.013 #    26.49    27134.16     1     3806     3.716  0.054


   ______COMPARING_THE_MEAN_SCORES_OF_PUPILS_WITHIN_ZONE_SUBGROUPS_______
                            ____________________F-TEST TABLE_________________
GROUPS       YEARS       #  ________SS________  ______DF______
======_____1978____1979__#__BETWEEN______WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
EARLY       90.77   92.71 #  2611.14 1305445.72     1     2788     5.577  0.018
LATE        92.41   92.69 #    28.95  602856.27     1     1399     0.067  0.796
MALE        90.51   92.90 #  3162.19 1054389.95     1     2232     6.694  0.010
NORTH       86.33   91.77 # 11121.50  972259.87     1     1518    17.364  0.000
SOUTH       94.18   93.08 #   873.29  996565.56     1     2851     2.498  0.114
PUBLIC      91.14   92.83 #  2552.94 1654781.67     1     3611     5.571  0.018
SEPARATE    92.14   91.83 #    18.17  347175.29     1      788     0.040  0.842
```

FIGURE 29

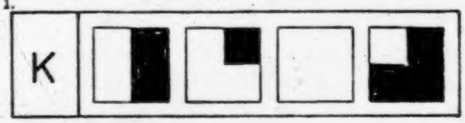
LEVEL B (Grade 2)

NUMBER

OBJECTIVE 7 *Identifies and represents fractions (halves and quarters) in a concrete setting.*

TEST ITEMS

1.



Say, "In the box at the top of the page, the one with the letter K, put a circle around the square that is half black--<u>repeat</u> put a circle around the square that is half black."

6.

$1 \quad \frac{1}{4} \quad \frac{1}{2} \quad \frac{4}{1}$

Say, "Watch me. Look at this sheet of cardboard." Hold up the cardboard sheet that has one quarter blackened.

Say, "In the next box, box number 6, draw a circle around the number that shows how much of this sheet is black--circle the number that shows how much is black."

20. Color in 1/2 of the circle.

Color in 1/4 of the rectangle.

ANALYSIS

```
_ZONE_ONE__PUPILS_IN_1978_AND_1979_ACHIEVING_WITHIN_EACH_CATAGCRY_A-D_
     CRITERION CATEGORIES FOR     GRADE:2    STRAND:1    OBJECTIVE: 7
          TOTAL NUMBER OF PUPILS:  1978 N=2303    1979 N=2070

          A: BELOW 50%       B:  50-64%         C:  65-84%        D: 85-100%
        ____1978____1979_____1978____1979_____1978____1979_____1978____1979_
NUMBER(%)   8.51    7.05     18.84   18.79    34.43   32.46    38.21   41.69
MEAN (%)   21.46   21.66     50.04   50.53    75.02   75.03   100.00   99.97

           TABLES COMPARING 1978 AND 1979 MEAN SCORES AND PROPORTIONS
   ___PROPORTION TEST___  #  ____________________F-TEST____________________
   HO: PRCPOR78=PROPOR79  #  _________SS_________   ______DF______
   _T-CALC____DF____PROB_#__BETWEEN_____WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
A:    1.792  4371   0.073 #       3.36   30330.72      1      340    0.038  0.846
B:    0.045  4371   0.964 #      48.65    2311.71      1      821   17.279  0.000
C:    1.378  4371   0.169 #       0.05     272.72      1     1463    0.288  0.592
D:   -2.347  4371   0.019 #       0.37     311.78      1     1741    2.042  0.153


   ______COMPARING_THE_MEAN_SCORES_CF_PUPILS_WITHIN_ZONE_SUBGROUPS_______
                             __________________F-TEST TABLE__________________
GROUPS        YEARS       #  _________SS_________   ______DF______
======_____1978____1979__#__BETWEEN_____WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
EARLY       74.87   76.73 #   2382.57 1633773.92     1     2788    4.066  0.044
LATE        76.21   77.94 #   1043.58  846467.18     1     1399    1.725  0.189
MALE        74.42   76.65 #   2771.28 1377985.21     1     2232    4.489  0.034
FEMALE      76.22   77.49 #    847.97 1212588.11     1     2137    1.494  0.222
NORTH       75.88   75.42 #     76.68 1012435.24     1     1518    0.115  0.735
SOUTH       74.97   77.86 #   5952.94 1577241.02     1     2851   1C.760  0.001
PUBLIC      75.14   76.23 #   1066.60 2200108.33     1     3611    1.751  0.186
SEPARATE    76.10   80.86 #   4317.90  385846.11     1      758    8.483  0.004
```

FIGURE 30

85-100 percent level only about forty percent could identify the number of 100's, 10's, or 1's in a given three-digit number at the same achievement level.

Over eighty-five percent of the pupils in 1978 and 1979 achieved in category D on the skill of identifying multiples by counting by 5's, 10's and 100's. The mean performances of all sub-groups were above 90 percent.

Grade two pupils had some difficulty identifying the common fractions of one-half and one-quarter (Figure 30). Still about three-quarters of the Zone One students could correctly answer three of the four fraction items in both 1978 and 1979.

OPERATIONS AND PROPERTIES (Six objectives; Figures 31 to 36)

Hypothesis 1

None of the objectives in this strand had achievement standings whereby eighty percent of the Zone One students were in category D (85-100 percent) in 1978 or 1979.

Hypothesis 2

Three objectives had significant increases from 1978 to 1979 in the proportion of students achieving in the 85-100 percent category.

Findings

Significantly (.000) more pupils in 1979 could symbolize addition and subtraction situations; still about twenty-two percent of the Zone One pupils had a zero score for this skill. Pupils could actually perform the addition

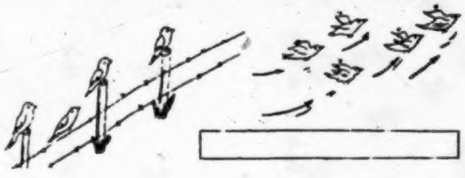
LEVEL B (Grade 2)

OPERATIONS AND PROPERTIES

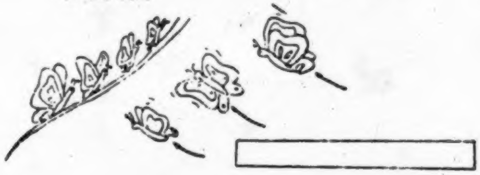
OBJECTIVE 1 *Symbolizes addition and subtraction situations in both the horizontal and vertical form.*

TEST ITEMS

24. Nine birds were sitting on a fence. Five birds flew away. Write the number sentence in the box.



25. Four butterflies were sitting on a limb. Three more flew to them. Write the number sentence in the box.



ANALYSIS

```
   _ZONE_ONE__PUPILS_IN_1978_AND_1979_ACHIEVING_WITHIN_EACH_CATAGORY_A-D_
        CRITERION CATEGORIES FOR     GRADE:2    STRAND:2    OBJECTIVE: 1
             TOTAL NUMBER OF PUPILS:  1978 N=2303    1979 N=2070

             A: BELOW 50%        B:  50-64%          C:  65-84%          D: 85-100%
         ____1978____1979_____1978____1979_____1978____1979_____1978____1979_
NUMBER(%)    29.14    22.32     12.77    13.14      0.30     0.19    57.79    64.35
MEAN (%)      0.19     0.49     50.04    50.05     75.00    75.00    99.99    99.98

             TABLES COMPARING 1978 AND 1979 MEAN SCORES AND PROPORTIONS
   ___PROPORTION TEST___  #  ____________________F-TEST______________________
   HO: PROPOR78=PROPOR79  #  ________SS________  ______DF______
   _T-CALC___DF____PROB_#__BETWEEN_____WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
A:    5.137   4371   0.000 #      24.74      8617.14     1      1131      3.248  0.072
B:   -0.368   4371   0.713 #       0.00       311.39     1       564      0.003  0.956
C:    0.730   4371   0.466 #  <<<<<<<<<<<<< SSW IS EQUAL TO ZERO >>>>>>>>>>>>>>
D:   -4.434   4371   0.000 #       0.06       468.16     1      2661      0.333  0.564

     _____COMPARING_THE_MEAN_SCORES_OF_PUPILS_WITHIN_ZONE_SUBGROUPS______
                                 ____________________F-TEST TABLE________________
GROUPS          YEARS        #   ________SS________  ______DF______
======______1978____1979__#__BETWEEN_____WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
EARLY        63.91     71.09 #  35731.24 5135063.40     1      2788     19.400  0.000
LATE         64.10     71.18 #  17534.06 2633147.15     1      1399      9.316  0.002
MALE         62.47     69.76 #  29585.30 4249318.36     1      2232     15.540  0.000
FEMALE       66.55     72.63 #  19678.41 3795680.25     1      2137     11.079  0.001
NORTH        63.08     68.09 #   9416.86 2866372.20     1      1518      4.987  0.026
SOUTH        65.25     72.67 #  39143.12 5180385.77     1      2851     21.542  0.000
PUBLIC       64.84     70.47 #  28519.58 6714992.48     1      3611     18.336  0.000
SEPARATE     62.56     74.33 #  26280.64 1337642.88     1       788     14.892  0.000
```

FIGURE 31

LEVEL B (Grade 2)

OPERATIONS
AND PROPERTIES

OBJECTIVE 2 *Understands the basis of the commutative property for addition.*

TEST ITEMS

23. Complete the following:

A + B = B + ____

26. Complete the following:

7 + 6 = 6 + ____

9 + ____ = 8 + 9

____ + 3 = 3 + 5

4 + 6 = ____ + 4

ANALYSIS

```
  _ZONE_ONE__PUPILS_IN_1978_AND_1979_ACHIEVING_WITHIN_EACH_CATAGCRY_A-D_
      CRITERION CATEGORIES FOR     GRADE:2   STRAND:2   OBJECTIVE: 2
            TOTAL NUMBER OF PUPILS:  1978 N=2303    1979 N=2070

            A: BELOW 50%       B:  50-64%       C:  65-84%       D: 85-100%
        ____1978____1979_____1978____1979_____1978____1979_____1978____1979_
NUMBER(%)  23.97   17.97     6.08     6.09    17.33   17.63    52.63   58.31
MEAN (%)   12.97   16.55    50.00    50.00    71.39   71.10   100.00   99.95

             TABLES COMPARING 1978 AND 1979 MEAN SCORES AND PROPORTIONS
   ___PROPORTION TEST___ #  ____________________F-TEST_______________________
   HO: PRCPOR78=PROPOR79 #  _________SS_________  ______DF______
   _T-CALC____DF____PROB_#__BETWEEN_____WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
A:    4.851  4371    0.000 #  2858.85  201193.88     1      922    13.101  0.000
B:   -0.011  4371    0.991 # <<<<<<<<<<<<<< SSW IS EQUAL TO ZERO >>>>>>>>>>>>>>
C:   -0.267  4371    0.789 #    16.13   42283.17     1      762     0.291  0.590
D:   -3.774  4371    0.000 #     0.03      69.39     1     2417     1.004  0.317

   _____CCMPARING_THE_MEAN_SCORES_OF_PUPILS_WITHIN_ZONE_SUBGROUPS_______
                            ____________________F-TEST TABLE__________________
GROUPS         YEARS      #  _________SS_________  ______DF______
======_____1978____1979__#__BETWEEN_____WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
EARLY       70.78   76.31 #  21186.03 3371049.85     1     2788    17.522  0.000
LATE        71.21   77.47 #  13736.18 1714510.41     1     1399    11.208  0.001
MALE        69.44   75.81 #  22656.33 2776438.25     1     2232    18.214  0.000
FEMALE      72.94   77.94 #  13375.23 2499536.76     1     2137    11.435  0.001
NORTH       71.80   71.52 #     29.79 2028331.14     1     1518     0.022  0.881
SOUTH       70.76   79.46 #  53929.19 3227737.37     1     2851    47.635  0.000
PUBLIC      70.97   76.18 #  24446.34 4431134.86     1     3611    19.922  0.000
SEPARATE    72.01   79.97 #  12028.87  849494.43     1      788    10.733  0.001
```

FIGURE 32

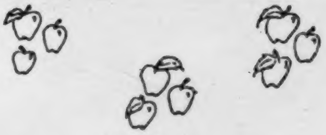
LEVEL B (Grade 2)

OPERATIONS
AND PROPERTIES

OBJECTIVE 3 *Understands the processes of multiplication and division.*

TEST ITEMS

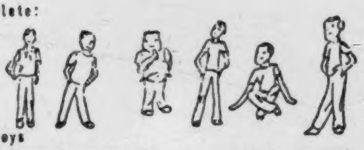
27. Complete:



3 sets of 3 apples _____ apples.

28. Draw 15 balls.
Use all the balls to make 3 equal groups.

29. Complete:



6 boys

Make 3 equal groups of boys. _____ boys in each group.

ANALYSIS

```
 _ZONE_ONE__PUPILS_IN_1978_AND_1979_ACHIEVING_WITHIN_EACH_CATAGORY_A-D_
      CRITERION CATEGORIES FOR     GRADE:2   STRAND:2   OBJECTIVE: 3
           TOTAL NUMBER OF PUPILS:  1978 N=2303    1979 N=2070

            A: BELOW 50%        B:  50-64%        C:  65-84%         D: 85-100%
        ____1978____1979_____1978____1979_____1978____1979_____1978____1979_
NUMBER(%)  36.73     36.81     7.29     5.46     28.40    26.57     27.57    31.16
MEAN (%)   25.13     24.46    50.00    50.00     71.01    70.41     99.99   100.00

            TABLES CCMPARING 1978 AND 1979 MEAN SCORES AND PROPCRTIONS
  ___PROPORTION TEST___ #  ____________________F-TEST_______________________
  HO: PRCPOR78=PROPOR79 #  ________SS________  _______DF______
   T-CALC____DF____PROB_#__BETWEEN_____WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
A:  -0.053  4371   0.958 #   176.72  326850.65    1      1606     0.868   0.352
B:   2.472  4371   0.013 #  <<<<<<<<<<<<< SSW IS EQUAL TO ZERO >>>>>>>>>>>>>>
C:   1.351  4371   0.177 #   108.50   61477.42    1      1202     2.121   0.146
D:  -2.603  4371   0.010 #     0.06      69.34    1      1278     1.016   0.314


  ______CCMPARING_THE_MEAN_SCORES_OF_PUPILS_WITHIN_ZONE_SUBGROUPS_______
                              ___________________F-TEST TABLE_________________
GROUPS         YEARS       #  ________SS________  _______DF______
======_____1978____1979__#__BETWEEN_____WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
EARLY        59.92    62.29 #   3879.52 2968890.92    1      2788     3.643   0.057
LATE         61.82    60.72 #    421.96 1439903.80    1      1359     0.410   0.522
MALE         59.94    61.23 #    928.56 2360219.26    1      2232     0.878   0.349
FEMALE       61.32    61.98 #    237.20 2225985.39    1      2137     0.228   0.633
NORTH        59.47    59.62 #      8.72 1741113.35    1      1518     0.008   0.931
SOUTH        61.27    62.57 #   1195.50 2840790.03    1      2851     1.200   0.274
PUBLIC       60.74    61.17 #    169.97 3849314.87    1      3611     0.159   0.690
SEPARATE     60.01    63.88 #   2415.95  736328.20    1       788     2.487   0.115
```

FIGURE 33

LEVEL B (Grade 2)

OPERATIONS AND PROPERTIES

OBJECTIVE 4

Demonstrates mastery of basic facts involving sums and minuends to 18.

TEST ITEMS

14. Find the sum.

```
   6       9       4       7
 + 7     + 5     + 8     + 9

   7       9       4       9       5
 + 8     + 9     + 7     + 6     + 8
```

15. Subtract:

```
  14      11      13      16      12
 - 8     - 6     - 9     - 9     - 7

  15      17      18      14      12
 - 6    - 10     - 8     - 7     - 9
```

16. Solve the following:

16 - 8 = ____

4 + 6 = ____

13 + 4 = ____

15 - 7 = ____

12 + 6 = ____

11 - 3 = ____

3 + 14 = ____

17 - 9 = ____

6 + 8 = ____

7 + 9 = ____

15 - 10 = ____

14 - 5 = ____

5 + 11 = ____

ANALYSIS

```
_ZCNE_ONE__PUPILS_IN_1978_AND_1979_ACHIEVING_WITHIN_EACH_CATAGCRY_A-D_
    CRITERION CATEGORIES FOR     GRADE:2   STRAND:2   CEJECTIVE: 4
          TOTAL NUMBER OF PUPILS:  1978 N=2303    1979 N=2070

                                                               D: 85-100%
           A: BELOW 50%       B:  50-64%          C:  65-84%
                                               _1978____1979_____1978____1979_
       ____1978____1979_____1978____1979_____  20.97    19.76    37.43    34.44
NUMBER(%)  27.40    29.03    14.20    16.76    75.57    74.64    95.35    95.38
MEAN (%)   30.51    30.60    56.70    56.35

         TABLES COMPARING 1978 AND 1979 MEAN SCORES AND PROPCRTIONS
                                  _____________________F-TEST_____________________
   ___PROPORTION TEST___ #                 ______DF______
   HO: PRCPOR78=PROPOR79 #  ________SS________
   _T-CALC____DF____PROB_#__BETWEEN_____WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
A:   -1.200  4371    0.231 #      2.66  187220.16     1       1230     0.017  0.895
B:   -2.345  4371    0.019 #     20.63   13641.56     1        672     1.016  0.314
C:    0.995  4371    0.320 #    190.91   35054.35     1        850     4.847  0.028
D:    2.053  4371    0.040 #      0.39   27454.07     1       1573     0.022  0.881

     _____COMPARING_THE_MEAN_SCORES_OF_PUPILS_WITHIN_ZONE_SUBGROUPS______
                               __________________F-TEST TABLE_______________
                               __________________
GROUPS          YEARS      #  ________SS________   ______DF______
======_____1978____1979__#__BETWEEN_____WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
EARLY      67.89    66.43 #   1487.38 2116004.99     1      2788     1.960  0.162
LATE       67.68    64.55 #   3417.80 1044650.12     1      1359     4.577  0.033
MALE       65.95    64.23 #   1629.78 1725360.36     1      2232     2.108  0.147
FEMALE     70.05    67.69 #   2964.86 1554768.80     1      2137     4.075  0.044
NORTH      67.41    67.50 #      3.03 1273273.88     1      1518     0.004  0.952
SOUTH      68.26    65.17 #   6800.79 2019874.88     1      2851     9.599  0.002
PUBLIC     68.60    65.80 #   7099.38 2700788.77     1      3611     9.492  0.002
SEPARATE   64.70    66.55 #    650.19  590120.98     1       788     0.835  0.361
```

FIGURE 34

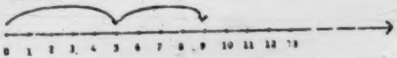
LEVEL B (Grade 2)

OPERATIONS
AND PROPERTIES
OBJECTIVE 5 *Solves picture and word problems.*
Estimates answers.

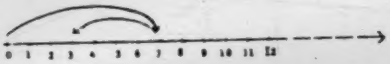
TEST ITEMS

30. Pat lived 12 blocks from school.
Jill lived 13 blocks from school.
Pat walked to school and then walked to Jill's house.
Write the number sentence to show how far she walked. ____________________
How far did she walk? ______ blocks.

31. Solve the number line problems. Fill in the boxes.



$\boxed{5} + \boxed{} = \boxed{}$



$\boxed{7} - \boxed{} = \boxed{}$

32. Ted had 35 cents.
He spent 12 cents.
Write the number sentence to show how much he has left. ____________________
How much does he have left? ____¢

ANALYSIS

```
_ZONE_ONE__PUPILS_IN_1978_AND_1979_ACHIEVING_WITHIN_EACH_CATAGCRY_A=D_
     CRITERION CATEGORIES FCR    GRADE:2   STRAND:2   OBJECTIVE: 5
          TOTAL NUMBER OF PUPILS:  1978 N=2303    1979 N=2070

                                                           D: 85-100%
            A: BELOW 50%      B:  50-64%        C:  65-84%
                                        1978____1979_____1978____1979_
        ____1978____1979_____1978____1979_____27.23    30.19    15.72    17.73
NUMBER(%)   42.68    39.66    14.37    12.42    73.15    73.41    99.56    99.67
MEAN (%)    16.71    18.17    50.73    50.57

          TABLES COMPARING 1978 AND 1979 MEAN SCORES AND PROPORTIONS
                                  _____________________F-TEST________________________
   ___PROPORTION TEST___ #  ____________________     ______DF______
   HO: PRCPOR78=PROPOR79 #  ________SS________   BETWEEN_WITHIN__F-RATIO__PROB
    T-CALC____DF____PROB_#__BETWEEN_____WITHIN_     1      1802     4.705   0.030
A:    2.027   4371   0.043 #    947.87  363058.30   1       566     0.751   0.387
B:    1.894   4371   0.058 #      3.83    2987.33   1      1250     0.352   0.553
C:   -2.168   4371   0.030 #     22.38   79517.73   1       727     0.704   0.402
D:   -1.781   4371   0.075 #      2.13    2159.99   1

      ______COMPARING_THE_MEAN_SCORES_OF_PUPILS_WITHIN_ZONE_SUBGROUPS_______
                                  _____________________F-TEST TABLE_________________
                                  ____________________    ______DF______
GROUPS         YEARS       #   ________SS________     BETWEEN_WITHIN__F-RATIO__PROB
======_____1978____1979__#__BETWEEN_____WITHIN___     1       2788    10.378   0.001
EARLY        48.78    52.87 #  11563.62 3106514.39    1       1359     2.289   0.131
LATE         51.45    54.12 #   2488.07 1520535.76    1       2232     3.583   0.059
MALE         49.29    51.95 #   3945.68 2457913.60    1       2137     7.809   0.005
FEMALE       50.73    54.74 #   8610.27 2356271.25    1       1518     0.092   0.761
NORTH        46.87    47.42 #    112.11 1840615.41    1       2851    13.491   0.000
SOUTH        51.79    56.20 #  13868.36 2930790.67    1       3611     1.993   0.158
PUBLIC       50.69    52.27 #   2254.00 4023498.85    1        728    26.804   0.000
SEPARATE     46.53    58.11 #  25458.06  719948.53    1
```

FIGURE 35

LEVEL B (Grade 2)

OPERATIONS AND PROPERTIES

OBJECTIVE 6 *Adds and subtracts to 99 with no regrouping.*

TEST ITEMS

33. Solve the following:

$$\begin{array}{r} 85 \\ -\ 31 \\ \hline \end{array} \qquad \begin{array}{r} 63 \\ +\ 25 \\ \hline \end{array} \qquad \begin{array}{r} 54 \\ -\ 32 \\ \hline \end{array} \qquad \begin{array}{r} 76 \\ +\ 21 \\ \hline \end{array}$$

$$\begin{array}{r} 69 \\ -\ 58 \\ \hline \end{array} \qquad \begin{array}{r} 44 \\ +\ 35 \\ \hline \end{array} \qquad \begin{array}{r} 96 \\ -\ 25 \\ \hline \end{array} \qquad \begin{array}{r} 82 \\ -\ 41 \\ \hline \end{array}$$

ANALYSIS

```
 _ZONE_ONE__PUPILS_IN_1978_AND_1979_ACHIEVING_WITHIN_EACH_CATAGORY_A-D_
      CRITERION CATEGCRIES FOR     GRADE:2   STRAND:2   OBJECTIVE: 6
           TOTAL NUMBER OF PUPILS:  1978 N=2303    1979 N=2070

          A: BELOW 50%      B:  50-64%        C:  65-84%       D: 85-100%
      ____1978____1979_____1978____1979_____1978____1979_____1978____1979_
NUMBER(%)  9.21   12.37    11.81    8.89     9.68   10.39    69.30   68.36
MEAN (%)  15.29   11.16    58.50   58.36    74.99   75.06    95.57   96.08

           TABLES COMPARING 1978 AND 1979 MEAN SCORES AND PROPCRTIONS
   ___PROPORTION TEST___ #  ___________________F-TEST_____________________
   HO: PRCPOR78=PROPOR79 #  _________SS________  ______DF______
   _T-CALC____DF____PROB_#__BETWEEN_____WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
A:  -3.377  4371   0.001 #   1976.81  101594.13    1       466     9.067  0.003
B:   3.157  4371   0.002 #      2.34   15539.06    1       454     0.068  0.794
C:  -0.774  4371   0.439 #      0.57     301.96    1       436     0.823  0.365
D:   0.673  4371   0.501 #      8.33  102038.49    1      3009     0.246  0.620


   _____CCMPARING_THE_MEAN_SCORES_OF_PUPILS_WITHIN_ZONE_SUBGROUPS______
                                  ____________________F-TEST TABLE________________
GROUPS         YEARS       #  _________SS________  ______DF______
======_____1978____1979__#__BETWEEN_____WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
EARLY       81.62   80.85 #    409.38 2107636.81    1      2788     0.542  0.462
LATE        83.21   79.59 #   4572.31 1030782.03    1      1399     6.206  0.013
MALE        80.39   77.86 #   3559.29 1823322.76    1      2232     4.357  0.037
FEMALE      83.87   82.30 #   1318.48 1465703.39    1      2137     1.922  0.166
NORTH       80.53   79.50 #    358.89 1257479.51    1      1518     0.467  0.495
SOUTH       82.98   80.30 #   5128.14 2005267.41    1      2851     7.291  0.007
PUBLIC      82.35   79.59 #   6856.37 2788547.52    1      3611     8.879  0.003
SEPARATE    80.80   82.10 #    320.70  514996.07    1       758     0.472  0.492
```

FIGURE 36

and subtraction algorithms with two digit numbers more successfully than the symbolizing of the operations. About eighty percent of pupils had scores between 65 and 100 percent on the two digit problems.

One-quarter of the grade two pupils did not understand the commutative property for addition.

Thirty-six percent of the students in both 1978 and 1979 had achievement scores at the 25 percent level on understanding the process of multiplication and division. Although significantly more pupils in 1979 achieved at the 85-100 percent level, this proportion only reached slightly over thirty percent.

Grade two's in Zone One did poorly on solving picture and word problems. Less than twenty percent of the population was able to reach the 85-100 percent level. Sub-group mean scores ranged from 47 to 58 percent.

MEASUREMENT (Ten objectives; Figures 37 to 46)

Hypothesis 1

One objective had performances where eighty percent of the Zone One pupils in 1978 and 1979 were in the 85-100 percent achievement category.

Hypothesis 2

Eight objectives had significant increases in the proportion of pupils achieving at the 85-100 percent level in 1979 over 1978.

Findings

Grade two pupils had some difficulty with the time concepts. While close to seventy percent of the pupils in 1978 and 1979 could tell time (hour, half and quarter hour) to the 85-100 percent achievement level, only about twenty percent could write the time using standard notation to the same level. Similarly the calendar achievement figures were such that less than sixty percent of the pupils could read the dates on the calendar or recite the months of the year in order to the 85-100 percent level.

Achievement in the Metric System varied extensively from one concept to another. Only thirty percent of the grade two pupils could estimate and measure using the standard units of length (m, cm), capacity (L), and mass (kg) to the 85-100 percent criterion category. An additional fifty-five percent, however, had scores in categories B and C (50-84 percent) on this same objective.

Most pupils could identify all the proper measuring instruments for a given task. Performance means for all but one sub-group were in the low 90 percent and a significant increase of 1979 pupils (eighty-three percent) received 100 percent scores on the one item.

About three-quarters of the pupils in the zone in 1979 could read three of the four Celsius thermometer items to ten degree intervals. This represented a significant increase over the 1978 performance.

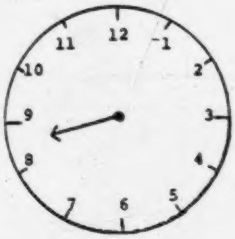
The money items in Figure 44 in particular gave many

LEVEL B (Grade 2)

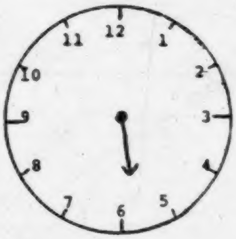
MEASUREMENT **OBJECTIVE 1** *Tells the time to hour, half hour, and quarter hour.*

TEST ITEMS

9. Put the minute hand on each clock.



8 30



5 45

ANALYSIS

```
 _ZONE_ONE__PUPILS_IN_1978_AND_1979_ACHIEVING_WITHIN_EACH_CATAGORY_A=D_
     CRITERION CATEGCRIES FOR    GRADE:2   STRAND:2   OEJECTIVE: 6
          TOTAL NUMBER OF PUPILS:  1978 N=2303   1979 N=2070

            A: BELOW 50%       B:  50-64%        C:  65-84%       D: 85-100%
        ____1978____1979_____1978____1979_____1978____1979_____1978____1979_
NUMBER(%)    9.21    12.37     11.81    8.69      9.68   10.39     69.30   68.36
MEAN (%)    15.29    11.16     58.50   58.36     74.99   75.06     95.97   96.08

           TABLES CCMPARING 1978 AND 1979 MEAN SCORES AND PROPORTIONS
   ___PROPORTION TEST___ #  ____________________F-TEST______________________
   HO: PRCPOR78=PROPOR79 #  _________SS________  ______DF______
   _T-CALC____DF____PROB_#__BETWEEN_____WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
A:  -3.377   4371    0.001 #  1976.81  101594.13     1       466    9.067   0.003
B:   3.157   4371    0.002 #     2.34   15539.06     1       454    0.068   0.794
C:  -0.774   4371    0.439 #     0.57     301.96     1       436    0.823   0.365
D:   0.673   4371    0.501 #     8.33  102038.49     1      3009    0.246   0.620

     ______COMPARING_THE_MEAN_SCORES_OF_PUPILS_WITHIN_ZONE_SUBGROUPS_______
                            ____________________F-TEST TABLE_________________
GROUPS          YEARS      #  _________SS________  ______DF______
======_____1978____1979__#__BETWEEN_____WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
EARLY      81.62   80.85 #    409.38 2107636.81     1      2768    0.542   0.462
LATE       83.21   79.59 #   4572.31 1030782.03     1      1399    6.206   0.013
MALE       80.39   77.86 #   3559.29 1823322.76     1      2232    4.357   0.037
FEMALE     83.87   82.30 #   1318.48 1465703.39     1      2137    1.922   0.166
NORTH      67.76   73.30 #  12824.51 2324476.48     1      1518    8.375   0.004
SOUTH      74.20   74.93 #    382.38 3877172.83     1      2851    0.281   0.596
PUBLIC     71.36   74.29 #   7755.82 5221871.92     1      3611    8.363   0.021
SEPARATE   74.23   75.40 #    262.84  999707.86     1       788    0.199   0.655
```

FIGURE 37

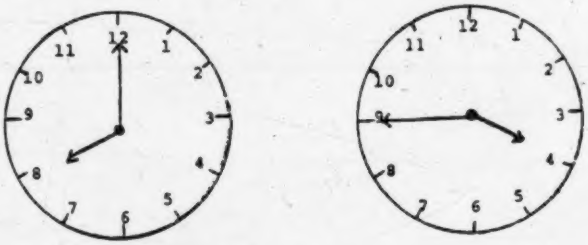
LEVEL B (Grade 2)

MEASUREMENT

OBJECTIVE 2 *Writes the hour, half hour and quarter hour using standard notation.*

TEST ITEMS

10. Print the time (Example: 2 30) below each clock.



________ ________

ANALYSIS

```
 ZONE ONE  PUPILS IN 1978 AND 1979 ACHIEVING WITHIN EACH CATAGORY A-D
     CRITERION CATEGORIES FOR     GRADE:2   STRAND:3   OBJECTIVE: 2
          TOTAL NUMBER OF PUPILS:  1978 N=2303    1979 N=2070

           A: BELOW 50%       B:  50-64%        C:  65-84%        D: 85-100%
       ____1978____1979_____1978____1979_____1978____1979_____1978____1979_
NUMBER(%)  19.15    14.35     62.48   63.82     0.0      0.0      18.37   21.84
MEAN (%)    0.0      0.0      50.00   50.00   ******  ******    100.00  100.00

            TABLES COMPARING 1978 AND 1979 MEAN SCORES AND PROPORTIONS
   ___PROPORTION TEST___ #  ____________________F-TEST_____________________
   HO: PROPOR78=PROPOR79 #  _________SS_________  ______DF______
   _T-CALC____DF____PROB_#__BETWEEN_____WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
A:   4.232  4371   0.000 #  <<<<<<<<<<<<<< SSW IS EQUAL TO ZERO >>>>>>>>>>>>>>
B:  -0.912  4371   0.362 #  <<<<<<<<<<<<<< SSW IS EQUAL TO ZERO >>>>>>>>>>>>>>
C:   0.0    4371   1.000 #  <<<<<<<< TOO FEW PUPILS FOR CALCULATIONS >>>>>>>>
D:  -2.862  4371   0.004 #  <<<<<<<<<<<<<< SSW IS EQUAL TO ZERO >>>>>>>>>>>>>>


   ______COMPARING THE MEAN SCORES OF PUPILS WITHIN ZONE SUBGROUPS______
                            ____________________F-TEST TABLE___________________
GROUPS        YEARS      #  _________SS_________  ______DF______
======______1978____1979__#__BETWEEN_____WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
EARLY        48.57   53.90 #  19654.81 2499933.90    1      2788   21.920  0.000
LATE         50.69   52.23 #    827.05 1256317.84    1      1399    0.921  0.337
MALE         49.70   55.17 #  16641.76 2096715.45    1      2232   17.716  0.000
FEMALE       49.51   52.26 #   4044.32 1902023.94    1      2137    4.544  0.033
NORTH        48.52   52.88 #   7141.74 1612535.89    1      1518    6.723  0.010
SOUTH        50.24   54.17 #  10993.42 2388249.49    1      2851   13.124  0.000
PUBLIC       49.43   53.33 #  13701.91 3363068.09    1      3611   14.712  0.000
SEPARATE     50.52   55.65 #   4997.41  638042.07    1       788    8.937  0.015
```

FIGURE 38

LEVEL B (Grade 2)

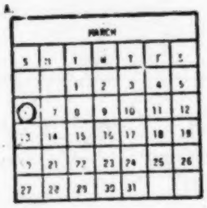
MEASUREMENT

OBJECTIVE 3 *Reads the dates on the calendar.*

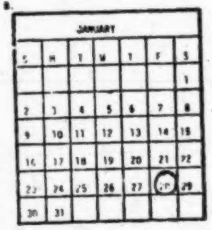
TEST ITEMS

11. What date (day, month, and date) is circled on each calendar? Print it below the calendar.

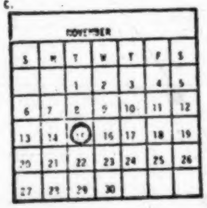
A.



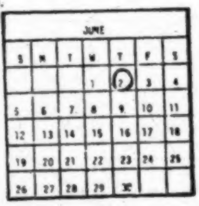
B.



C.



D.



ANALYSIS

```
 _ZCNE_ONE__PUPILS_IN_1978_AND_1979_ACHIEVING_WITHIN_EACH_CATAGCRY_A-C_
      CRITERICN CATEGCRIES FOR     GRADE:2   STRAND:3   OBJECTIVE: 3
           TOTAL NUMBER OF PUPILS:  1978 N=2303    1979 N=2070

                                                             D: 85-100%
            A: BELOW 50%      B:  50-64%        C:  65-84%
                                     1978___1979____1978___1979____1978___1979_
         ____1978____1979_____1978____1979_____1978____1979_____1978____1979_
                                                           55.54    58.36
NUMBER(%)  27.01    27.68     4.99     3.82     12.46    10.14
MEAN (%)    3.14     2.71    50.00    50.00     75.00    75.00    100.00   100.00

         TABLES COMPARING 1978 AND 1979 MEAN SCORES AND PROPCRTIONS
                              ____________________F-TEST_____________________
  ___PROPORTION TEST___ #  ____________________
  HO: PRCPOR78=PROPOR79 #  _________SS________   ______DF______
  _T-CALC____DF____PROB_#__BETWEEN______WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
A:  -0.499   4371   0.618 #    55.14   77193.81     1     1193    0.852  0.356
B:   1.887   4371   0.059 #  <<<<<<<<<<<<<< SSW IS EQUAL TC ZERO >>>>>>>>>>>>>>
C:   2.410   4371   0.016 #  <<<<<<<<<<<<<< SSW IS EQUAL TO ZERO >>>>>>>>>>>>>>
D:  -1.881   4371   0.060 #  <<<<<<<<<<<<<< SSW IS EQUAL TC ZERO >>>>>>>>>>>>>>

      ______COMPARING_THE_MEAN_SCORES_OF_PUPILS_WITHIN_ZONE_SUBGROUPS_______
                              ____________________F-TEST TABLE________________
                              ____________________
GROUPS          YEARS       #  _________SS_________   ______DF______
======______1978____1979__#__BETWEEN______WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
EARLY        67.56    67.43 #     10.43 5028677.07    1      2788    0.006  0.939
LATE         69.26    70.25 #    346.26 2421456.02    1      1399    0.200  0.655
MALE         65.23    65.37 #     10.44 4079066.60    1      2232    0.006  0.940
FEMALE       71.37    72.00 #    209.50 3646682.15    1      2137    0.123  0.726
NORTH        61.49    63.24 #   1146.22 2996273.19    1      1518    0.581  0.446
SOUTH        72.11    71.25 #    529.34 4684419.40    1      2851    0.322  0.870
PUBLIC       68.88    67.01 #   3153.86 6452183.11    1      3611    1.765  0.184
SEPARATE     65.01    76.01 #  22959.67 1288421.91    1       788   13.808  0.000
```

FIGURE 39

LEVEL B (Grade 2)

MEASUREMENT

OBJECTIVE 4 *Recites months of the year in order.*

TEST ITEMS

Teacher Record of Lab Success

Circle the appropriate student response description.

28.	Correct / Incorrect	The student names months of year in order.

ANALYSIS

```
 _ZONE_ONE__PUPILS_IN_1978_AND_1979_ACHIEVING_WITHIN_EACH_CATAGCRY_A-D_
      CRITERION CATEGORIES FOR     GRADE:2   STRAND:3   OBJECTIVE: 4
             TOTAL NUMBER OF PUPILS:  1978 N=2303    1979 N=2070

              A: BELOW 50%       B:  50-64%        C:  65-84%        D: 85-100%
          ____1978____1979_____1978____1979_____1978____1979__.___1978____1979_
NUMBER(%)     50.59    38.41     0.30     0.92     0.22     0.39    48.89   60.29
MEAN (%)       0.0      0.0     50.00    50.00    75.00    75.00   100.00  100.00

             TABLES CCMPARING 1978 AND 1979 MEAN SCORES AND PROPORTIONS
    ___PROPORTION TEST___ #  ____________________F-TEST____________________
    HO: PRCPOR78=PROFOR79 #  ________SS________  ______DF______
     _T-CALC____DF____PROB_#__BETWEEN______WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
A:     8.087   4371   0.000 #  <<<<<<<<<<<<<< SSW IS EQUAL TO ZERO >>>>>>>>>>>>>>
B:    -2.637   4371   0.008 #  <<<<<<<<<<<<<< SSW IS EQUAL TC ZERO >>>>>>>>>>>>>>
C:    -1.027   4371   0.305 #  <<<<<<<<<<<<<< SSW IS EQUAL TO ZERO >>>>>>>>>>>>>>
D:    -7.854   4371   0.000 #  <<<<<<<<<<<<<< SSW IS EQUAL TO ZERO >>>>>>>>>>>>>>

        ______COMPARING_THE_MEAN_SCORES_OF_PUPILS_WITHIN_ZONE_SUBGROUPS______
     ______________________________________F-TEST TABLE____________________
                                 ____________________
GROUPS          YEARS         #  ________SS________   ______DF______
======______1978_____1979__#__BETWEEN_____WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
EARLY         47.26    58.72  #   90879.84  6808805.65    1      2768    37.213   0.000
LATE          53.71    64.58  #   41273.99  3319276.98    1      1399    17.393   0.000
MALE          40.57    54.60  #  109577.87  5418421.51    1      2232    45.138   0.000
FEMALE        58.28    67.72  #   47485.38  4901585.44    1      2137    20.703   0.000
NORTH         45.58    56.56  #   45[illegible].79  3728688.41    1      1518    18.459   0.000
SOUTH         81.30    63.22  #  1012[illegible]8.36  6823060.70    1      2851    42.306   0.000
PUBLIC        48.63    59.04  #   97545.46  8805762.04    1      3611    46.001   0.000
SEPARATE      62.06    70.16  #   62214.43  1742140.84    1       788    27.069   0.000
```

FIGURE 40

LEVEL B (Grade 2)

MEASUREMENT

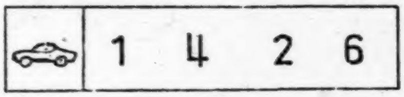
OBJECTIVE 5 *Estimates and uses standard units of length, capacity, and mass. m, cm, ℓ, kg .*

TEST ITEMS

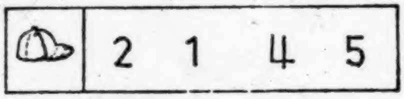
5. Draw a line 4 cm long.

6. Draw a line 10 cm long.

7.



8.



29. Correct / Incorrect

The student uses a 1 litre measure to determine the capacity of a 3 litre or 4 litre container.

30. Correct / Incorrect

The student uses a balance scale and kg weights to determine the mass of a 2 kg or 3 kg object.

ANALYSIS

```
 _ZONE_ONE__PUPILS_IN_1978_AND_1979_ACHIEVING_WITHIN_EACH_CATAGORY_A-D_
     CRITERION CATEGORIES FOR     GRADE:2   STRAND:3   OBJECTIVE: 5
           TOTAL NUMBER OF PUPILS:  1978 N=2303    1979 N=2070

          A: BELOW 50%       B:  50-64%        C:  65-84%       D: 85-100%
      ____1978____1979_____1978____1979_____1978____1979_____1978____1979_
NUMBER(%)  17.28   13.48    19.84   16.91    36.17   38.16    26.70   31.45
MEAN (%)   31.68   30.29    54.89   54.60    75.28   75.97    96.34   96.19

          TABLES COMPARING 1978 AND 1979 MEAN SCORES AND PROPORTIONS
   ___PROPORTION TEST___ #  ____________________F-TEST_____________________
   HO: PROPOR78=PROPOR79 #  _________SS________  ______DF______
   _T-CALC____DF____PROB_#__BETWEEN_____WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
A:    3.472  4371   0.001 #    318.04  103474.22     1      675    2.075  0.150
B:    2.498  4371   0.013 #     16.87   13709.04     1      805    0.990  0.320
C:   -1.363  4371   0.173 #    193.24   73357.28     1     1621    4.270  0.039
D:   -3.454  4371   0.001 #      7.71   21739.70     1     1264    0.448  0.503

   ______COMPARING_THE_MEAN_SCORES_OF_PUPILS_WITHIN_ZONE_SUBGROUPS_______
                            ____________________F-TEST TABLE________________
GROUPS        YEARS     #   _________SS________  ______DF______
======_____1978____1979_#__BETWEEN_____WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
EARLY       68.92   71.98 #   6522.64 1468556.64    1     2788   12.383  0.001
LATE        70.12   72.48 #   1949.32  768238.34    1     1399    3.550  0.060
MALE        69.22   73.24 #   9004.12 1151124.08    1     2232   17.459  0.000
FEMALE      69.43   71.84 #   3111.14 1181936.26    1     2137    5.625  0.018
NORTH       67.07   67.70 #    147.49  827124.76    1     1518    0.271  0.603
SOUTH       70.62   74.92 #  13197.05 1476469.87    1     2851   25.483  0.000
PUBLIC      68.99   71.30 #   4801.19 1965736.64    1     3611    8.820  0.003
SEPARATE    70.94   78.27 #  10203.65  352336.73    1      758   21.952  0.000
```

FIGURE 41

LEVEL B (Grade 2)

MEASUREMENT

OBJECTIVE 6 *Identifies proper measuring instruments for a given task.*

TEST ITEMS

12. Place the letters on the blanks beside the measuring instrument that would answer the question:

A. How heavy?

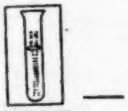
B. How long?

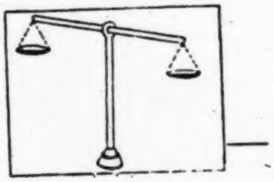
C. How much water?

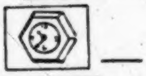
D. How cold?

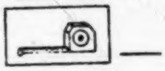
E. What time?

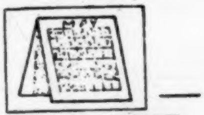
F. What day?

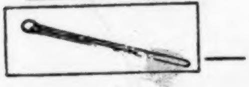












ANALYSIS

```
 _ZCNE_ONE__PUPILS_IN_1978_AND_1979_ACHIEVING_WITHIN_EACH_CATAGCRY_A=D_
     CRITERION CATEGORIES FOR     GRADE:2   STRAND:3   CBJECTIVE: 6
          TOTAL NUMBER OF PUPILS:  1978 N=2303    1979 N=2070

                                                 C:  65-84%         D: 85-100%
          A: BELOW 50%        B:  50-64%      1978___1979_____1978____1979_
      ____1978____1979_____1978____1979_____   9.60     8.16     80.16    83.14
NUMBER(%)    8.25     6.76      2.00     1.93    71.53    71.30   100.00   100.00
MEAN (%)     9.39    13.04     50.00    50.00

             TABLES CCMPARING 1978 AND 1979 MEAN SCORES AND PROPCRTIONS
     ___PROPORTION TEST___ #  _____________________F-TEST_______________________
     HO: PRCPOR78=PROPOR79 #  ________SS________  ______DF______
      T-CALC____DF____PROB_#__BETWEEN_____WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
A:    1.259  4371   0.063 #   1073.73   65790.96    1       328     5.353   0.021
B:    0.155  4371   0.877 #  <<<<<<<<<<<<<< SSW IS EQUAL TO ZERO >>>>>>>>>>>>>>>
C:    1.659  4371   0.098 #      5.03   22042.87    1       388     0.089   0.766
D:   -2.541  4371   0.011 #      0.02      69.40    1      3565     1.073   0.301

        ______COMPARING_THE_MEAN_SCORES_OF_PUPILS_WITHIN_ZONE_SUBGROUPS_______
                              __________________F-TEST TABLE__________________
GROUPS         YEARS       #  ________SS________  ______DF______
======______1978____1979__#__BETWEEN_____WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
EARLY       88.65    91.41 #  5267.83 1711879.33     1      2788     8.579   0.003
LATE        89.17    90.69 #   810.29  897664.61     1      1399     1.263   0.261
MALE        88.80    90.73 #  2082.94 1427159.57     1      2232     3.258   0.071
FEMALE      88.79    90.88 #  2333.99 1348671.80     1      2137     3.698   0.055
NORTH       83.81    86.75 #  3280.43 1289255.24     1      1518     3.827   0.051
SOUTH       91.67    92.78 #   883.84 1437024.07     1      2851     1.753   0.186
PUBLIC      88.42    90.18 #  2787.22 2417323.41     1      3611     4.164   0.042
SEPARATE    90.61    93.64 #  1736.39  353332.96     1       758     3.725   0.054
```

FIGURE 42

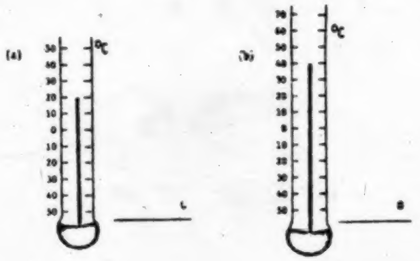
LEVEL B (Grade 2)

MEASUREMENT

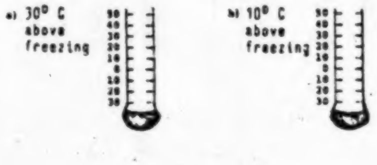
OBJECTIVE 7 *Reads the Celsius thermometer to ten degree intervals.*

TEST ITEMS

13. What temperature is shown on each thermometer?



14. Color each thermometer to show the temperature.



ANALYSIS

```
_ZONE_ONE__PUPILS_IN_1978_AND_1979_ACHIEVING_WITHIN_EACH_CATAGORY_A-D_
    CRITERION CATEGORIES FOR    GRADE:2   STRAND:3   OBJECTIVE: 7
          TOTAL NUMBER OF PUPILS:  1978 N=2303   1979 N=2070

            A: BELOW 50%       B:  50-64%        C:  65-84%        D: 85-100%
        ____1978____1979_____1978____1979_____1978____1979_____1978____1979_
NUMBER(%)   6.12    5.75     20.58   17.34    16.80   14.64    56.49   62.27
MEAN (%)    9.40    6.72     50.00   50.00    75.00   75.00   100.00  100.00

           TABLES COMPARING 1978 AND 1979 MEAN SCORES AND PROPORTIONS
  ___PROPORTION TEST___ #  ____________________F-TEST____________________
  HO: PROPOR78=PROPOR79 #  _________SS________  ______DF______
  _T-CALC____DF____PROB_#__BETWEEN_____WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
A:   0.522  4371   0.602 #   461.60   35295.61    1      258     3.374  0.067
B:   2.723  4371   0.007 # <<<<<<<<<<<<<< SSW IS EQUAL TO ZERO >>>>>>>>>>>>>>
C:   1.962  4371   0.050 # <<<<<<<<<<<<<< SSW IS EQUAL TC ZERO >>>>>>>>>>>>>>
D:  -3.883  4371   0.000 # <<<<<<<<<<<<<< SSW IS EQUAL TO ZERO >>>>>>>>>>>>>>


  ------COMPARING_THE_MEAN_SCORES_OF_PUPILS_WITHIN_ZONE_SUBGROUPS-------
                           __________________F-TEST TABLE_________________
GROUPS        YEARS      #  _________SS________  ______DF______
======______1978____1979__#__BETWEEN_____WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
EARLY        79.84   82.25 #   4036.07 1943446.91    1      2788     5.790  0.016
LATE         80.40   81.75 #    639.16 1101218.44    1      1359     0.812  0.368
MALE         80.06   81.93 #   1931.09 1573560.46    1      2232     2.739  0.098
FEMALE       79.88   82.70 #   4328.68 1595159.39    1      2137     5.799  0.016
NORTH        77.76   80.46 #   2729.73 1260263.28    1      1518     3.314  0.069
SOUTH        81.23   83.21 #   2791.78 1908922.64    1      2851     4.170  0.041
PUBLIC       79.37   80.93 #   2190.45 2737343.52    1      3611     2.890  0.090
SEPARATE     82.86   88.58 #   6201.68  409969.38    1       758    11.466  0.001
```

FIGURE 43

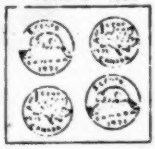
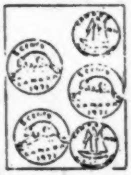
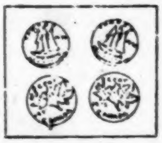
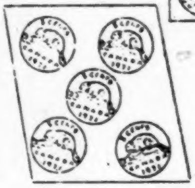
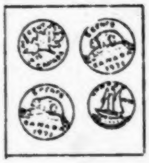
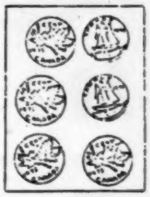
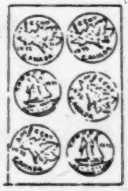
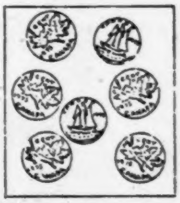
LEVEL B (Grade 2)

MEASUREMENT

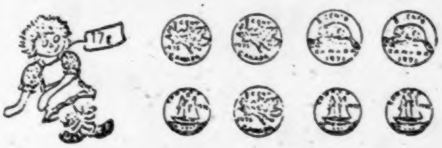
OBJECTIVE 8 *Counts collections of coins up to 25¢.*

TEST ITEMS

16. Put an X on the two boxes of coins that have a value of 25¢.

17. Circle the coins to show how much the doll costs.



ANALYSIS

```
 ZONE ONE  PUPILS IN 1978 AND 1979 ACHIEVING WITHIN EACH CATAGCRY A-D
     CRITERION CATEGCRIES FOR     GRADE:2    STRAND:3    CEJECTIVE: 8
           TOTAL NUMEER OF PUPILS:  1978 N=2303     1979 N=2070

            A: BELOW 50%        B:  50-64%          C:  65-84%          D: 85-100%
       ____1978____1979_____1978____1979_____1978____1979_____1978____1979_
NUMBER(%)  20.97    17.87    17.19    16.43      9.16    9.42     52.67   56.28
MEAN (%)   11.59    12.70    50.00    50.00     75.00   75.00    100.00  100.0C

           TABLES CCMPARING 1978 AND 1979 MEAN SCCRES AND PROPORTIONS
   ___PROPORTION TEST___ #  _____________________F-TEST_____________________
   HO: PRCPCR78=PROPOR79 #  ,________SS_________  ______DF______
   _T-CALC____DF____PROB_#__BETWEEN_____WITHIN__BETWEEN_WITHIN__F-RATIC__PROB
A:   2.582  4371   0.010 #    257.44  132869.76    1      851     1.649  0.199
B:   0.679  4371   0.497 #  <<<<<<<<<<<<<< SSW IS ECUAL TC ZERC >>>>>>>>>>>>>>
C:  -0.294  4371   0.769 #  <<<<<<<<<<<<<< SSW IS ECUAL TC ZERO >>>>>>>>>>>>>>
D:  -2.393  4371   0.017 #  <<<<<<<<<<<<<< SSW IS EQUAL TC ZERO >>>>>>>>>>>>>>


   ______CCMPARING THE MEAN SCORES OF PUPILS WITHIN ZONE SUBGROUPS______
                             ____________________F-TEST TABLE__________________
GROUPS        YEARS        #  _________SS_________  ______DF______
======______1978____1979_#__BETWEEN_____WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
EARLY        70.34   74.45 #  11718.98 3432516.91     1       2788     9.519  0.002
LATE         70.63   71.85 #    515.84 1775684.20     1       1359     0.406  0.524
MALE         70.97   76.19 #  15119.77 2609396.79     1       2232    12.933  0.000
FEMALE       70.15   71.38 #    814.82 2787132.82     1       2137     0.625  0.429
NORTH        64.96   72.12 #  19251.58 2010840.52     1       1518    14.533  0.000
SOUTH        73.80   74.66 #    523.02 3353366.75     1       2851     0.445  0.505
PUBLIC       70.29   72.82 #   5777.89 4607529.61     1       3611     4.528  0.033
SEPARATE     71.97   78.43 #   7915.11  790821.73     1        758     7.587  0.006
```

FIGURE 44

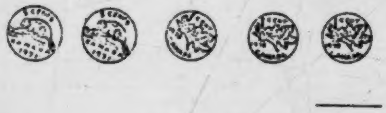
LEVEL B (Grade 2)

MEASUREMENT

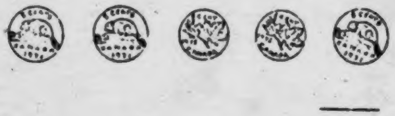
OBJECTIVE 9 *Gives equivalent value of coins to 25¢.*

TEST ITEMS

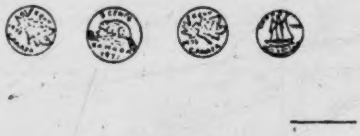
19. How much money is there in each set of coins below? Write the answer in the blank.



21.



20.



ANALYSIS

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_ZONE_ONE__PUPILS_IN_1978_AND_1979_ACHIEVING_WITHIN_EACH_CATAGORY_A-D_
     CRITERION CATEGORIES FOR     GRADE:2    STRAND:3   OBJECTIVE: 9
            TOTAL NUMBER OF PUPILS:  1978 N=2303    1979 N=2070

            A: BELOW 50%        B:  50-64%         C:  65-84%          D: 85-100%
        ____1978____1979_______1978____1979______1978____1979______1978____1979_
NUMBER(%)  16.54    14.54       5.86    5.17     26.79   24.69     50.80    55.60
MEAN (%)    9.73    12.76      50.62   50.23     73.41   72.78     99.84    95.88

             TABLES COMPARING 1978 AND 1979 MEAN SCORES AND PROPORTIONS
   ___PROPORTION TEST___ #   ____________________F-TEST______________________
   HO: PROPOR78=PROPOR79 #   ________SS________  ______DF______
   _T-CALC____DF____PROB_#__BETWEEN_____WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
A:   1.822  4371   0.069 #   1543.66  133069.41     1      680     7.888  0.005
B:   1.001  4371   0.318 #      8.79     845.50     1      240     2.494  0.116
C:   1.589  4371   0.113 #    108.88   18558.13     1     1126     6.606  0.010
D:  -3.176  4371   0.002 #      0.96    2728.94     1     2319     0.818  0.366


   _____COMPARING_THE_MEAN_SCORES_OF_PUPILS_WITHIN_ZONE_SUBGROUPS_______
                             __________________F-TEST TABLE________________
GROUPS        YEARS        #  ________SS________  ______DF______
======_____1978____1979__#__BETWEEN_____WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
EARLY       74.49   78.67 #  12075.46 2892657.12     1     2788    11.639  0.001
LATE        75.97   77.09 #    434.97 1401506.01     1     1399     0.434  0.510
MALE        74.88   79.28 #  10765.49 2178754.80     1     2232    11.029  0.001
FEMALE      75.05   76.58 #   1250.40 2327450.97     1     2137     1.148  0.284
NORTH       69.12   74.47 #  10751.32 1888001.93     1     1518     8.644  0.003
SOUTH       78.33   79.65 #   1243.03 2564433.79     1     2851     1.382  0.240
PUBLIC      75.06   76.92 #   3137.97 3782667.69     1     3611     2.996  0.084
SEPARATE    74.51   82.66 #  12631.02  717167.86     1      788    13.350  0.000
```

FIGURE 45

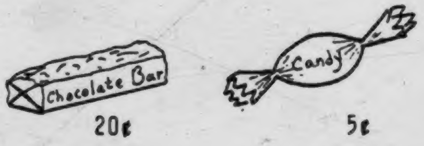
LEVEL B (Grade 2)

MEASUREMENT

OBJECTIVE 10 *Makes purchases up to 25¢.*

TEST ITEMS

15. How much for both?



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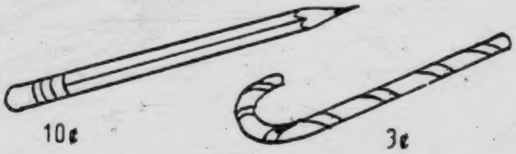
16. How much for both?



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ANALYSIS

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  _ZONE_ONE__PUPILS_IN_1978_AND_1979_ACHIEVING_WITHIN_EACH_CATAGORY_A-D_
      CRITERION CATEGORIES FOR     GRADE:2   STRAND:3   OBJECTIVE:10
           TOTAL NUMBER OF PUPILS:  1978 N=2303    1979 N=2070

           A: BELOW 50%        B:  50-64%         C:  65-84%        D: 85-100%
       ____1978____1979_____1978____1979_____1978____1979_____1978____1979_
NUMBER(%)   9.38     8.84     26.31    22.75     4.17     2.85    60.14   65.56
MEAN (X)    7.06     6.01     50.00    50.00    75.00    75.00   100.00  100.00

             TABLES COMPARING 1978 AND 1979 MEAN SCORES AND PROPCRTIONS
   ___PROPORTION TEST___ #  ____________________F-TEST______________________
   HO: PRCPOR78=PROPOR79 #  _________SS________  ______DF______
   _T-CALC____DF____PROB_#__BETWEEN_____WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
A:   0.617  4371   0.537 #   109.07   48246.20     1      397    0.897  0.344
B:   2.728  4371   0.007 #  <<<<<<<<<<<<<< SSW IS EQUAL TO ZERO >>>>>>>>>>>>>>
C:   2.354  4371   0.019 #  <<<<<<<<<<<<<< SSW IS EQUAL TO ZERO >>>>>>>>>>>>>>
D:  -3.698  4371   0.000 #  <<<<<<<<<<<<<< SSW IS EQUAL TO ZERO >>>>>>>>>>>>>>


   ______CCMPARING_THE_MEAN_SCORES_OF_PUPILS_WITHIN_ZONE_SUBGROUPS_______
                            ____________________F-TEST TABLE_________________
GROUPS       YEARS       #  _________SS________  ______DF______
======______1978____1979__#__BETWEEN_____WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
EARLY       76.69   80.07 #   7912.59 2682731.68    1      2788    8.223  0.004
LATE        78.20   78.04 #      8.57 1376954.31    1      1399    0.009  0.926
MALE        75.87   79.46 #   7177.34 2103776.39    1      2232    7.615  0.006
FEMALE      78.36   79.75 #   1026.88 2141896.22    1      2137    1.025  0.312
NORTH       71.44   77.25 #  12687.63 1652756.04    1      1518   11.378  0.001
SOUTH       80.34   80.75 #    118.85 2508630.28    1      2881    0.136  0.713
PUBLIC      77.08   78.24 #   1218.11 3583308.94    1      3611    1.228  0.268
SEPARATE    77.13   85.82 #  14383.60  648445.74    1       788   16.779  0.000
```

FIGURE 46

students trouble. While the mean scores on these items, for all sub-groups, were in the 70-80 percent range, over thirty percent of the pupils had achievement figures at or below the 50 percent level. Pupils did somewhat better on counting up the printed values of purchased items than they did on counting and giving equivalent values of sets of pictured coins (Figures 43-45).

GEOMETRY (Three objectives; Figures 47 to 48)

Hypothesis 1

No objectives had performances where eighty percent of the Zone One pupils in 1978 and 1979 were in the 85-100 percent achievement level.

Hypothesis 2

One objective had a significant increase in the proportion of pupils achieving at the 85-100 percent level in 1979 over 1978.

Findings

About three-quarters of the pupils were able to classify 2 and 3-dimensional figures and objects according to various attributes within achievement categories C and D for both 1978 and 1979.

Significantly more pupils in 1979 were able to develop geometric patterns using 2-dimensional figures. Still only sixty-three percent of the zone one grade two pupils came within the 85-100 percent category.

LEVEL B (Grade 2)

GEOMETRY

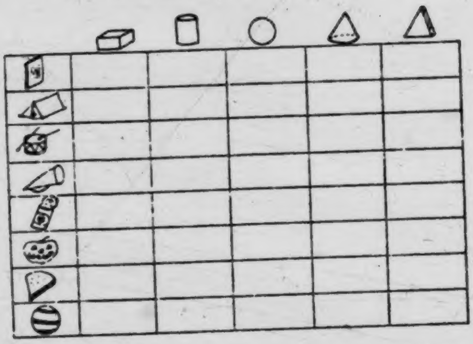
OBJECTIVE

1 *Classifies 3-dimensional objects in relation to corners, edges, and faces.*

2 *Classifies 2-dimensional figures in relation to boundaries, corners and faces.*

TEST ITEMS

22. Check which shape it is most like.



ANALYSIS

```
 ZCNE ONE  PUPILS IN 1978 AND 1979 ACHIEVING WITHIN EACH CATAGCRY A-C
     CRITERION CATEGORIES FOR     GRADE:2   STRAND:4   OBJECTIVE: 1,2
          TOTAL NUMBER OF PUPILS:  1978 N=2303    1979 N=2070

          A: BELOW 50%       B:  50-64%         C:  65-84%         D: 85-100%
                                              1978     1979      1978     1979
        1978     1979      1978     1979      19.89    20.00     53.45    55.99
NUMBER(%)  11.03    9.02      15.63    14.98     75.00    75.00     93.08    92.62
MEAN (%)   13.36    14.74     58.44    58.27

            TABLES COMPARING 1978 AND 1979 MEAN SCORES AND PROPCRTIONS
    ___PROPORTION TEST___ #  ____________________F-TEST______________________
    HO: PRCPOR78=PROPOR79 #  _______SS_______   ______DF______
     T-CALC    DF    PROB #  BETWEEN     WITHIN  BETWEEN WITHIN  F-RATIO  PROB
                             204.54    99811.40     1      439    0.900  0.343
A:   2.188   4371   0.025 #    4.89    23189.14     1      668    0.141  0.708
B:   0.601   4371   0.548 # <<<<<<<<<<<<< SSW IS EQUAL TO ZERO >>>>>>>>>>>>>>
C:  -0.093   4371   0.926 #  127.38    91342.61     1     2388    3.330  0.068
D:  -1.683   4371   0.093 #

     ______COMPARING THE MEAN SCORES OF PUPILS WITHIN ZONE SUBGROUPS_______
                          _____________________F-TEST TABLE__________________
GROUPS        YEARS        #  ________SS________  ______DF______
======_____1978____1979__#__BETWEEN_____WITHIN__BETWEEN WITHIN__F-RATIO__PROB
                              1780.39 1773542.26    1      2788    2.799  0.094
EARLY       75.22    76.82 #  1569.26  915820.72    1      1399    2.397  0.122
LATE        74.58    76.70 #   859.53 1473385.18    1      2232    1.302  0.254
MALE        75.42    76.67 #  2240.90 1325202.59    1      2137    3.614  0.058
FEMALE      75.13    77.18 #  5327.91 1200172.47    1      1518    6.739  0.010
NORTH       72.47    76.24 #    87.36 1587646.52    1      2851    0.157  0.692
SOUTH       76.90    77.25 #  1437.14 2415500.02    1      3611    2.148  0.143
PUBLIC      75.30    76.86 #  2133.53  382068.31    1       758    4.233  0.040
SEPARATE    75.19    78.55 #
```

FIGURE.47

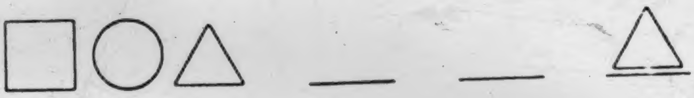
LEVEL B (Grade 2)

GEOMETRY

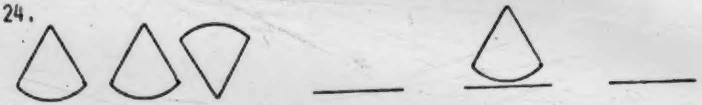
OBJECTIVE 3 *Develops geometrical patterns using 3-dimensional objects and 2-dimensional figures.*

TEST ITEMS

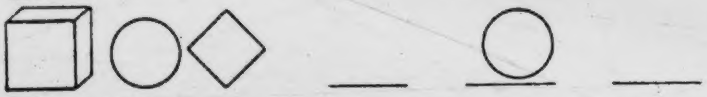
23. Draw the missing shapes:



24.



25.



ANALYSIS

```
_ZONE_ONE__PUPILS_IN_1978_AND_1979_ACHIEVING_WITHIN_EACH_CATAGORY_A-D_
     CRITERION CATEGORIES FOR     GRADE:2    STRAND:4    OBJECTIVE: 3
          TOTAL NUMBER OF PUPILS:  1978 N=2303    1979 N=2070

           A: BELOW 50%      B:  50-64%        C:  65-84%         D: 85-100%
       ____1978____1979_____1978____1979_____1978____1979_____1978____1979_
NUMBER(%)  23.23     18.21      1.74     1.30    16.15   17.10     58.88   63.38
MEAN (%)   12.24     12.95     50.42    50.00    70.81   69.84     99.93   99.98

          TABLES COMPARING 1978 AND 1979 MEAN SCORES AND PROPORTIONS
   ___PROPORTION TEST___ #  ____________________F-TEST______________________
   HO: PROPOR78=PROPOR79 #  _________SS________  ______DF______
   _T-CALC____DF____PROB_#__BETWEEN_____WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
A:    4.078  4371    0.000 #    111.53  222248.36     1       910     0.457  0.499
B:    1.163  4371    0.245 #      2.80     131.94     1        65     1.379  0.245
C:   -0.842  4371    0.400 #    169.37   34341.27     1       724     3.571  0.059
D:   -3.048  4371    0.003 #      1.99    1033.82     1      2666     5.144  0.024

     ______COMPARING_THE_MEAN_SCORES_OF_PUPILS_WITHIN_ZONE_SUBGROUPS______
                            ____________________F-TEST TABLE__________________
GROUPS         YEARS       #  _________SS________  ______DF______
======______1978____1979__#__BETWEEN______WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
EARLY       73.59     77.70 #  11755.02 3571080.00     1      2788     9.177  0.003
LATE        74.17     78.91 #   7832.61 1765744.10     1      1359     6.206  0.013
MALE        70.67     75.85 #  14909.86 3020186.75     1      2232    11.019  0.001
FEMALE      77.49     80.90 #   6207.69 2449114.37     1      2137     5.417  0.020
NORTH       74.86     80.22 #  10799.24 1881274.91     1      1518     8.714  0.003
SOUTH       73.49     77.40 #  10878.03 3623317.90     1      2851     8.559  0.004
PUBLIC      72.95     77.27 #  16772.54 4685817.57     1      3611    12.926  0.000
SEPARATE    79.15     83.15 #   3052.24  800751.76     1       728     2.889  0.090
```

FIGURE 48

GRAPHING (Two objectives; Figures 49 and 50)

Hypothesis 1

The null hypothesis held for the two objectives in the graphing strand. Neither had eighty percent of the pupils achieving in the 85-100 percent category for 1978 or 1979.

Hypothesis 2

One objective had a significant increase in the 1979 proportion of pupils achieving at the 85-100 percent level in 1979 over 1978.

Findings

Less than seventy percent of the pupils in 1978 and 1979 were able to construct simple bar and pictographs at the 85-100 percent level. About one-quarter of the pupils could not make a bar graph from the information given in a comparative situation.

More students were able to locate the position of an object on a 10 to 10 grid. About seventy-five percent of the grade two's reached category D on the grid item.

A. DISCUSSION OF THE GRADE TWO RESULTS

The mean achievement scores for Zone One pupils on the basis of objectives and strands are given in Table 8. The figures here and in Tables 9 and 10 indicate some of a parallel performance for the two years. Generally the objectives that gave students difficulty in 1978 also did so in 1979.

The overall achievement scores for grade two are

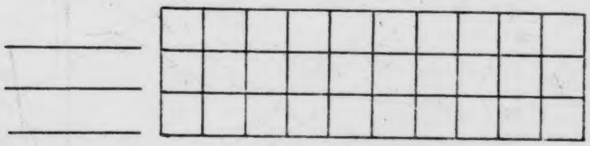
LEVEL B (Grade 2)

GRAPHING

OBJECTIVE 1 *Constructs simple bar and pictographs using data collected from immediate environment.*

TEST ITEMS

26. In Mrs. Brown's class, 10 children like art best, 5 like gym best, and 8 like music best. Make a bar graph to show what they like.



ANALYSIS

```
   _ZONE_ONE__PUPILS_IN_1978_AND_1979_ACHIEVING_WITHIN_EACH_CATAGORY_A-D_
       CRITERION CATEGORIES FOR     GRADE:2   STRAND:5   CEJECTIVE: 1
            TOTAL NUMBER OF PUPILS:  1978 N=2303   1979 N=2070

          A: BELOW 50%        B:  50-64%         C:  65-84%         D: 85-100%
       ____1978____1979_____1978____1979_____1978____1979_____1978____1979_
NUMBER(%)  27.96   25.17      4.26    3.29      4.65    3.96    63.14   67.58
MEAN (%)    3.27    4.73     50.00   50.00     68.85   68.60   100.00  100.00

            TABLES CCMPARING 1978 AND 1979 MEAN SCORES AND PROPCRTIONS
   ___PROPORTION TEST___ #  ___________________F-TEST______________________
   HC: PRCPOR78=PROPOR79 #  ________SS________  ______DF______
   _T-CALC___DF___PROB_#__BETWEEN_____WITHIN_ BETWEEN WITHIN__F-RATIO__PROB
A:    2.087  4371   0.037 #   614.48  129960.99    1      1163     5.499  0.019
B:    1.676  4371   0.094 #  <<<<<<<<<<<<<< SSW IS EQUAL TO ZERO >>>>>>>>>>>>>>
C:    1.112  4371   0.267 #     2.90    4671.56    1       187     0.116  0.734
D:   -3.085  4371   0.002 #  <<<<<<<<<<<<<< SSW IS EQUAL TC ZERO >>>>>>>>>>>>>>


   ______COMPARING_THE_MEAN_SCORES_OF_PUPILS_WITHIN_ZONE_SUBGROUPS______
                                        __________________F-TEST TABLE________________
GROUPS           YEARS         #   _______SS________  ______DF______
======______1978_____1979__#__BETWEEN______WITHIN__BETWEEN WITHIN__F-RATIO__PROB
EARLY          68.04    73.02 #  17231.64 5073689.41     1       2788     9.469  0.002
LATE           70.64    73.85 #   3594.75 2462468.28     1       1399     2.042  0.153
MALE           68.91    72.66 #   7847.06 4004771.71     1       2232     4.373  0.037
FEMALE         69.87    73.63 #   7532.68 3828567.14     1       2137     4.205  0.041
NORTH          64.94    63.67 #    612.39 3138627.19     1       1518     0.296  0.586
SOUTH          71.93    77.75 #  24116.49 4579273.27     1       2851    15.015  0.000
PUBLIC         67.88    70.79 #   7638.54 6806167.66     1       2611     4.053  0.044
SEPARATE       76.76    83.83 #   9479.49  950928.40     1        758     7.856  0.006
```

FIGURE 49

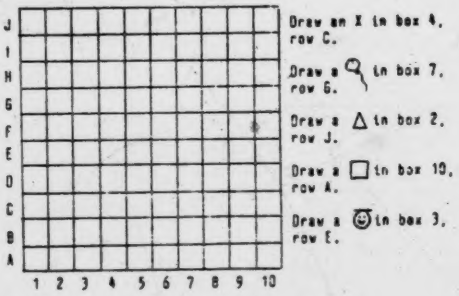
LEVEL B (Grade 2)

GRAPHING

OBJECTIVE 2 *Locates position of an object on a 10 x 10 grid.*

TEST ITEMS

27.



Draw an X in box 4, row C.

Draw a 🎈 in box 7, row G.

Draw a △ in box 2, row J.

Draw a □ in box 10, row A.

Draw a ☺ in box 3, row E.

ANALYSIS

```
 _ZONE_ONE__PUPILS_IN_1978_AND_1979_ACHIEVING_WITHIN_EACH_CATAGORY_A-D_
     CRITERION CATEGORIES FOR     GRADE:2   STRAND:5   OBJECTIVE: 2
          TOTAL NUMBER OF PUPILS:  1978 N=2303    1979 N=2070

           A: BELOW 50%       B:  50-64%        C:  65-84%        D: 85-100%
      ____1978____1979_____1978____1979_____1978____1979_____1978____1979_
NUMBER(%)  12.81    10.58      3.21    2.95     12.33   12.13     71.65   74.35
MEAN (%)    6.54     9.25     59.59   58.69     79.98   79.90     99.98   99.99

             TABLES COMPARING 1978 AND 1979 MEAN SCORES AND PROPORTIONS
    ___PROPORTION TEST___ #  ___________________F-TEST_____________________
    HO: PROPOR78=PROPOR79 #  ________SS________  ______DF______
     T-CALC    DF    PROB # BETWEEN     WITHIN  BETWEEN WITHIN  F-RATIO  PROB
A:    2.286  4371   0.022 #   919.14   88723.91     1      512    5.304  0.022
B:    0.508  4371   0.611 #    27.45     982.92     1      133    3.714  0.056
C:    0.208  4371   0.836 #     0.90     147.42     1      533    3.239  0.072
D:   -2.008  4371   0.045 #     0.00     424.36     1     3167    0.028  0.868


    ______COMPARING_THE_MEAN_SCORES_OF_PUPILS_WITHIN_ZONE_SUBGROUPS______
                             ___________________F-TEST TABLE_________________
GROUPS         YEARS       #  ________SS________  ______DF______
======_____1978____1979__#__BETWEEN_____WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
EARLY       83.33   86.44 #   6672.01 2623589.68     1      2788    7.090  0.008
LATE        85.54   87.09 #    846.29 1222641.08     1      1399    0.968  0.325
MALE        82.66   86.45 #   7979.34 2155712.93     1      2232    8.262  0.004
FEMALE      85.92   87.03 #    658.21 1813249.03     1      2137    0.776  0.379
NORTH       77.83   82.48 #   8125.35 1912609.85     1      1518    6.449  0.011
SOUTH       87.98   88.81 #    819.90 1989601.24     1      2851    0.745  0.388
PUBLIC      83.40   86.14 #   6771.79 3471852.91     1      3611    7.043  0.008
SEPARATE    88.48   89.44 #    183.09  491853.62     1       788    0.282  0.595
```

FIGURE 50

TABLE 8
THE 1978 AND 1979 ZONE ONE MEAN SCORES FOR GRADE TWO BY OBJECTIVES AND STRAND

ZONE ONE GRADE TWO JUNE/78

NUMBER		OPERATIONS & PROPERTIES		MEASUREMENT		GEOMETRY		GRAPHING	
1	91.7%	1	64.5%	1	71.8%	1	75.3%	1	69.4%
2	95.5%	2	71.1%	2	64.9%	2	75.3%	2	84.3%
3	92.6%	3	60.6%	3	68.2%	3	74.0%		
4	86.4%	4	67.9%	4	49.2%				
5	65.1%	5	50.0%	5	69.3%				
6	91.3%	6	82.1%	6	88.8%				
7	75.3%			7	80.0%				
				8	70.6%				
				9	75.0%				
				10	77.1%				
AVG	85.4%		66.0%		70.0%		74.9%		76.8%

ZONE ONE GRADE TWO JUNE/79

NUMBER		OPERATIONS & PROPERTIES		MEASUREMENT		GEOMETRY		GRAPHING	
1	90.6%	1	71.2%	1	74.5%	1	76.9%	1	73.1%
2	95.0%	2	76.9%	2	53.7%	2	76.9%	2	86.7%
3	91.5%	3	61.6%	3	68.6%	3	78.3%		
4	83.9%	4	65.9%	4	61.0%				
5	67.9%	5	53.3%	5	72.6%				
6	92.6%	6	80.0%	6	90.8%				
7	77.1%			7	82.3%				
				8	73.8%				
				9	78.0%				
				10	79.6%				
AVG	85.5%		68.2%		73.5%		77.4%		79.9%

reasonably good. Some of the performances within the Operations and Properties and Measurement strands tend to lower the overall means for these strands. The grade two

TABLE 9

ACHIEVEMENT MEANS IN 1978 AND 1979 WITHIN CATEGORIES A-D FOR THE NUMBER, OPERATIONS AND PROPERTIES, AND MEASUREMENT STRANDS

```
_ZONE_ONE__PUPILS_IN_1978_AND_1979_ACHIEVING_WITHIN_EACH_CATAGORY_A-D_
      CRITERION CATEGORIES FOR  GRADE:2  STRAND: NUMBER
          TOTAL NUMBER OF PUPILS:  1978 N=2303    1979 N=2070

                                                   C:  65-84%        D: 85-100%
            A: BELOW 50%        B:  50-64%        1978____1979_____1978____1979_
         ____1978____1979_____1978____1979_____  26.96    27.34     63.74    64.69
NUMBER(%)    2.65     2.85      6.64     5.12     76.51    76.62     93.96    93.79
MEAN (%)    37.31    31.82     58.66    58.71

              TABLES COMPARING 1978 AND 1979 MEAN SCORES AND PROPORTIONS
                                     _____________________F-TEST_______________________
   ___PROPORTION TEST___ #   ________SS________   ______DF______
   HO: PROPOR78=PROPOR79 #   ________SS________  ______DF______
    _T-CALC____DF____PROB_#__BETWEEN_____WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
                                905.62   24288.25     1      118     4.400  0.038
A:  -0.407   4371   0.684 #       0.13    4531.03     1      257     0.008  0.931
B:   2.130   4371   0.033 #       3.69   33324.69     1     1185     0.131  0.717
C:  -0.281   4371   0.779 #      20.46   71334.77     1     2805     0.804  0.370
D:  -0.649   4371   0.516 #


_ZONE_ONE__PUPILS_IN_1978_AND_1979_ACHIEVING_WITHIN_EACH_CATAGORY_A-D_
      CRITERION CATEGORIES FOR  GRADE:2  STRAND: OPERATIONS & PROPERTIES
          TOTAL NUMBER OF PUPILS:  1978 N=2303    1979 N=2070

                                                   C:  65-84%        D: 85-100%
            A: BELOW 50%        B:  50-64%        1978____1979_____1978____1979_
         ____1978____1979_____1978____1979_____  31.52    34.78     25.92    27.34
NUMBER(%)   24.71    20.08     17.85    17.83     75.07    74.71     92.08    91.74
MEAN (%)    33.55    34.29     57.23    57.26

              TABLES COMPARING 1978 AND 1979 MEAN SCORES AND PROPORTIONS
                                     _____________________F-TEST_______________________
   ___PROPORTION TEST___ #   ________SS________   ______DF______
   HO: PROPOR78=PROPOR79 #   ________SS________  ______DF______
    _T-CALC____DF____PROB_#__BETWEEN_____WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
                                132.98  136487.22     1      982     0.957  0.328
A:   3.683   4371   0.000 #       0.13   13234.64     1      778     0.007  0.931
B:   0.017   4371   0.986 #      46.69   47968.05     1     1444     1.406  0.236
C:  -2.287   4371   0.022 #      35.06   25442.15     1     1161     1.600  0.206
D:  -1.061   4371   0.289 #


_ZONE_ONE__PUPILS_IN_1978_AND_1979_ACHIEVING_WITHIN_EACH_CATAGORY_A-D_
      CRITERION CATEGORIES FOR  GRADE:2  STRAND: MEASUREMENT
          TOTAL NUMBER OF PUPILS:  1978 N=2303    1979 N=2070

                                                   C:  65-84%        D: 85-100%
            A: BELOW 50%        B:  50-64%        1978____1979_____1978____1979_
         ____1978____1979_____1978____1979_____  38.12    41.11     27.92    32.08
NUMBER(%)   15.94    11.50     18.02    15.31     75.17    75.50     91.48    91.69
MEAN (%)    33.48    35.45     57.84    58.57

              TABLES COMPARING 1978 AND 1979 MEAN SCORES AND PROPORTIONS
                                     _____________________F-TEST_______________________
   ___PROPORTION TEST___ #   ________SS________   ______DF______
   HO: PROPOR78=PROPOR79 #   ________SS________  ______DF______
    _T-CALC____DF____PROB_#__BETWEEN_____WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
                                558.74   94576.84     1      603     3.562  0.060
A:   4.244   4371   0.000 #      97.14   13008.94     1      730     5.451  0.020
B:   2.393   4371   0.017 #      46.92   54220.05     1     1727     1.495  0.222
C:  -2.017   4371   0.044 #      13.60   26894.89     1     1305     0.660  0.417
D:  -2.998   4371   0.003 #
```

TABLE 10

ACHIEVEMENT MEANS IN 1978 AND 1979 WITHIN CATEGORIES A-D FOR THE GEOMETRY AND GRAPHING STRANDS

```
_ZONE_ONE__PUPILS_IN_1978_AND_1979_ACHIEVING_WITHIN_EACH_CATAGORY_A-D_
   CRITERION CATEGORIES FOR  GRADE:2  STRAND: GEOMETRY
        TOTAL NUMBER OF PUPILS:  1978 N=2303   1979 N=2070

          A: BELOW 50%       B:  50-64%         C:  65-84%         D: 85-100%
      ____1978____1979_____1978____1979_____1978____1979_____1978____1979_
NUMBER(%)  12.42     9.86     14.16    11.16     34.30    36.47     39.12    42.51
MEAN (%)   26.95    26,70     57.04    57.13     76.77    77.21     94.82    94.60

            TABLES COMPARING 1978 AND 1979 MEAN SCORES AND PROPORTIONS
   ___PROPORTION TEST___ #  ____________________F-TEST_______________________
   HO: PROPOR78=PROPOR79 #  _________SS________  ______DF______
   _T-CALC____DF____PROB_#__BETWEEN_____WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
A:    2.683  4371   0.007 #      7.86  124548.66     1       488     0.031  0.861
B:    2.967  4371   0.003 #      1.06   12257.36     1       555     0.048  0.827
C:   -1.499  4371   0.134 #     76.87   57335.88     1      1543     2.069  0.151
D:   -2.278  4371   0.023 #     20.62   36002.39     1      1779     1.019  0.313


_ZONE_ONE__PUPILS_IN_1978_AND_1979_ACHIEVING_WITHIN_EACH_CATAGORY_A-D_
   CRITERION CATEGORIES FOR  GRADE:2  STRAND: GRAPHING
        TOTAL NUMBER OF PUPILS:  1978 N=2303   1979 N=2070

          A: BELOW 50%       B:  50-64%         C:  65-84%         D: 85-100%
      ____1978____1979_____1978____1979_____1978____1979_____1978____1979_
NUMBER(%)  13.85    11.50     17.33    15.46      9.60     9.47     59.23    63.57
MEAN (%)   16.47    19.24     50.91    50.74     76.11    75.61     98.62    98.66

            TABLES COMPARING 1978 AND 1979 MEAN SCORES AND PROPORTIONS
   ___PROPORTION TEST___ #  ____________________F-TEST_______________________
   HO: PROPOR78=PROPOR79 #  _________SS________  ______DF______
   _T-CALC____DF____PROB_#__BETWEEN_____WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
A:    2.331  4371   0.020 #   1044.77  169736.26     1       555     3.416  0.065
B:    1.662  4371   0.097 #      5.04    4951.90     1       717     0.729  0.393
C:    0.143  4371   0.886 #     25.59   15904.92     1       415     0.668  0.414
D:   -2.947  4371   0.003 #      0.89   31799.31     1      2678     0.075  0.785
```

program contains twenty-eight objectives as opposed to the eighteen in grade one. Statistical comparisons between the grades are not possible however.

Number

The grade two performance on the number strand appears to be adequate. Table 9 shows that over ninety percent of the grade two children achieved within Categories C and D.

The concept of place value which was of concern in grade one was also weak in grade two. This topic permeates the total mathematics program at the elementary level and so any lack of pupil understanding will undoubtly affect, not only the other number objectives, but some of the other strands as well. Since one quarter of the grade ones had difficulty, one could perhaps expect an increase in this failure proportion in grade two. This was in fact the situation.

Although the introduction of the common fractions one half and one quarter caused a few grade two's problems, the general reduction in the emphasis on fractions appears to have given a greater proportion of pupils some opportunity to succeed.

Operations and Properties

The distribution of achievement proportions given in Table 9 is indicative of some difficulties within this strand.

One obvious factor is that only about one-third of the pupils have committed the basic facts for addition and subtraction to memory. Grade two pupils did better on the addition and subtraction algorithms with two digits (Figure 36) than on the basic recall of the facts. The assumption might be that memorization has low priority with teachers.

It appears as though pupils may be introduced too quickly to the multiplication and division operations. Pupils should have shown a better grasp of adding and subtracting before they were introduced into the other two operations. This is supported in part by the low achievement figures for problem solving which involves making a choice about which operation to use. Teachers may be taking the listing of objectives in the 1977 Handbook as an indication of the sequence for teaching. This possibility should be eliminated.

Measurement

The distribution of achievement scores within the four categories as given in Table 9 may indicate that this strand is too demanding of grade two pupils.

The three objectives on money are very much dependent on the understanding of some of the Number and Operations concepts. Thus the difficulties which students have with counting coin collections or using coins for making small purchases likely stem from problems with basic number understanding.

The first entry of the Metric System with the skills of estimating and using the standard units of length (m,cm), capacity (L) and mass (g) appear to be in line with the capabilities of grade two pupils. The scores are low enough however to be of concern for the future extension of Metric measurement as a system.

Geometry

Most students in grade two experience a fair degree of success with the geometry objectives. However the requirements represent only a minimum extension of the grade one program. The format of the items measuring this strand may have confused some of the pupils in the lower achievement categories as they are somewhat complicated.

Graphing

It is somewhat surprising to find that students experienced more success with the locating of objects on a 10 x 10 grid than with the constructing of simple bar or pictographs. If objective 2 (Figure 50) was to be interpreted in the ordered pair form (1,2), which it sometimes is, the achievement picture may have been different.

CHAPTER VI

GRADE THREE

ANALYSIS OF HYPOTHESIS ONE AND TWO FOR GRADE THREE

NUMBER (Seven objectives; Figures 52 to 58)

Hypothesis 1

None of the objectives had performances where eighty percent of the Zone One pupils in 1978 and 1979 were in the 85-100 percent achievement category.

Hypothesis 2

Two objectives had significant increases in the proportion of pupils achieving at the 85-100 percent category from 1978 to 1979.

Findings

Slightly over seventy percent of the zone one pupils in both 1978 and 1979 achieved within category D (85-100 percent) in the order and betweeness concepts and on the use of symbols for equality and inequality. Sub-group means on the same were in the area of 85 percent.

Students have some difficulties with counting by 2's, 5's, 10's and 25's. Only about forty-five percent of these children performed at the 85-100 percent level. Approximatley twenty percent of the pupils achieved well below 50 percent. Performance on this skill remained fairly constant over the two testing periods.

PART	QUES.	STRAND	OBJ	RAW SCORE VALUE	%	PART	QUES.	STRAND	OBJ.	RAW SCORE VALUE	%
I	1	Operat. & Prop.	1	1	½	I	26	Number	7	2	½
I	2	Operat. & Prop.	1	1	½	I	27	Number	7	2	½
I	3	Operat. & Prop.	1	1	½	I	28	Number	7	2	½
I	4	Operat. & Prop.	1	1	½	I	29	Operat. & Prop.	7	24	6
I	5	Number	3	20	5	I	30	Operat. & Prop.	5	2	½
I	6	Number	6	4	1	I	31	Operat. & Prop.	5	2	½
I	7	Number	6	4	1	I	32	Number	2	16	4
I	8	Number	6	4	1	I	33	Number	4	12	3
I	9	Number	6	4	1	I	34	Number	5	16	4
I	10	Number	3	4	1	I	35	Operat. & Prop.	5	4	1
I	11	Number	3	4	1	I	36	Number	1	12	3
I	12	Number	3	4	1	I	37	Number	1	8	2
I	13	Operat. & Prop.	6	2	½	I	38	Operat. & Prop.	4	4	1
I	14	Operat. & Prop.	6	2	½	I	39	Operat. & Prop.	3	8	2
I	15	Operat. & Prop.	6	2	½	I	40	Operat. & Prop.	8	8	2
I	16	Operat. & Prop.	6	2	½	I	41	Operat. & Prop.	2	6	1½
I	17	Number	7	2	½	I	42	Operat. & Prop.	2	6	1½
I	18	Number	7	2	½	I	43	Operat. & Prop.	2	12	3
I	19	Number	7	2	½	I	44	Operat. & Prop.	1	8	2
I	20	Number	7	2	½	I	45	Operat. & Prop.	4	8	2
I	21	Number	7	2	½	I	46	Operat. & Prop.	9	4	1
I	22	Number	7	2	½	I	47	Operat. & Prop.	9	[illegible]	1
I	23	Number	7	2	½	I	48	Operat. & Prop.	9	4	1
I	24	Number	7	2	½	I	49	Operat. & Prop.	9	4	1
I	25	Number	7	2	½						

PART	QUESTION	STRAND	OBJ.	RAW SCORE VALUE	/%
II	1	Geometry	1	4	1
II	2	Geometry	1	4	1
II	3	Measurement	2	4	1
II	4	Graphing	3	10	2½
II	5	Graphing	4	4	1
II	6	Graphing	1	2	½
II	7	Geometry	4	4	1
II	8	Graphing	2	4	1
II	9	Graphing	2	4	1
II	10	Graphing	2	4	1
II	11	Measurement	6	4	1
II	12	Measurement	1	4	1
II	13	Measurement	3	4	1
II	14	Measurement	3	4	1
II	15	Measurement	4	8	2
II	16	Measurement	5	8	2
II	17	Measurement	9	4	1
II	18	Measurement	8	20	5
II	19	Geometry	2	12	3
II	20	Measurement	7	6	1½
II	21	Measurement	7	6	1½
II	22	Geometry	3	20	5

FIGURE 51

GRADE THREE DETAILED ANALYSIS OF MARK WEIGHTINGS

LEVEL C (Grade 3)

NUMBER

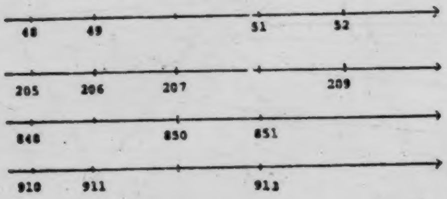
OBJECTIVE 1 *Orders and determines "betweenness" of whole numbers (0-1 000) and understands symbols >, < and = to show relationships.*

TEST ITEMS

36. Place >, < or = inside each circle.

a) 15 ○ 8
b) 81 ○ 18
c) 732 ○ 372
d) 101 ○ 110
e) 97 ○ 98
f) 909 ○ 909

37. Write in the missing number.



ANALYSIS

```
ZONE ONE  PUPILS IN 1978 AND 1979 ACHIEVING WITHIN EACH CATAGORY A-D
     CRITERION CATEGORIES FOR      GRADE:3   STRAND:1   OBJECTIVE: 1
          TOTAL NUMBER OF PUPILS:  1978 N=1912     1979 N=1810

            A: BELOW 50%       B:  50-64%        C:  65-84%        D: 85-100%
         ____1978____1979_____1978____1979_____1978____1979_____1978____1979_
NUMBER(%)    6.49     6.63     10.25    11.71     9.57    10.11    73.69   71.55
MEAN (%)    30.85    28.00     53.11    52.92    76.56    76.50    97.42   97.28

        TABLES COMPARING 1978 AND 1979 MEAN SCORES AND PROPORTIONS
  ___PROPORTION TEST___ #  ______________________F-TEST______________________
  HO: PROPOR78=PROPOR79 #  _________SS_________  ______DF______
  _T-CALC____DF____PROB_#__BETWEEN______WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
A:  -0.178   3720   0.859 #    494.22    57856.09     1      242     2.067   0.152
B:  -1.427   3720   0.154 #      3.59     8588.32     1      406     0.170   0.681
C:  -0.552   3720   0.581 #      0.27     8292.90     1      364     0.012   0.913
D:   1.462   3720   0.143 #     12.97    52626.37     1     2702     0.666   0.415

     ______COMPARING THE MEAN SCORES OF PUPILS WITHIN ZONE SUBGROUPS______
                          ____________________F-TEST TABLE____________________
GROUPS          YEARS       #  _________SS_________  ______DF______
======_____1978____1979__#__BETWEEN_____WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
EARLY        86.49    85.06 #   1249.09 1168276.49     1     2438     2.607   0.107
LATE         87.20    85.50 #    876.62  532238.47     1     1204     1.983   0.159
MALE         85.48    85.17 #     47.08  942739.80     1     1920     0.096   0.757
FEMALE       87.72    85.62 #   1976.13  726855.82     1     1798     4.516   0.034
NORTH        88.41    84.70 #   3375.28  458404.93     1      981     7.223   0.007
SOUTH        85.88    85.63 #     42.21 1270943.39     1     2737     0.091   0.763
PUBLIC       86.84    85.99 #    527.91 1339856.71     1     2941     1.159   0.282
SEPARATE     85.53    83.09 #   1156.76  389172.32     1      777     2.310   0.129
```

FIGURE 52

LEVEL C (Grade 3)

NUMBER

OBJECTIVE 2 *Identifies multiples by counting by 2's, 5's, 10's, 25's, 100's (0 - 1 000)*

TEST ITEMS

32. Fill in the blanks:

a) Count by 2's.

_____, _____, 6, _____, _____, _____, _____, _____.

b) Count by 25's.

_____, _____, 75, _____, _____, _____, _____, _____.

c) Count by 5's.

125, _____, _____, _____, _____, _____, _____, _____.

d) Count by 10's.

360, _____, _____, _____, _____, _____, _____, _____.

ANALYSIS

```
 _ZONE_ONE__PUPILS_IN_1978_AND_1979_ACHIEVING_WITHIN_EACH_CATAGCRY_A-D_
      CRITERION CATEGCRIES FOR     GRADE:3   STRAND:1   OBJECTIVE: 2
            TOTAL NUMBER OF PUPILS:  1978 N=1912    1979 N=1810

            A: BELOW 50%       B:  50-64%         C:  65-84%        D: 85-100%
         ____1978___1979_____1978____1979_____1978___1979_____1978____1979_
NUMBER(%)   22.75    20.33    15.38    14.36    16.84   20.66     45.03    44.64
MEAN (%)    19.31    19.23    50.06    50.24    75.04   75.00     99.96    99.96

            TABLES CCMPARING 1978 AND 1979 MEAN SCORES AND PROPORTIONS
   ___PROPORTION TEST___ #  ____________________F-TEST_____________________
   HO: PROPOR78=PROPOR79 #  ________SS________  ______DF______
   _T-CALC___DF___PROB_#__BETWEEN_____WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
A:    1.794  3720   0.073 #       1.43   91225.51     1       801     0.013  0.911
B:    0.867  3720   0.386 #       4.30     960.34     1       552     2.474  0.116
C:   -2.989  3720   0.003 #       0.26      77.64     1       694     2.331  0.127
D:    0.239  3720   0.811 #       0.01     817.47     1      1667     0.020  0.887


   _____COMPARING_THE_MEAN_SCORES_OF_PUPILS_WITHIN_ZONE_SUBGROUPS______
                            ____________________F-TEST TABLE________________
GROUPS          YEARS      #  ________SS________  ______DF______
======______1978___1979__#__BETWEEN_____WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
EARLY       69.00   70.93 #    2263.32 2599974.12     1      2438     2.122  0.145
LATE        71.05   71.29 #      16.68 1224824.61     1      1204     0.016  0.898
MALE        70.52   73.34 #    3816.64 2066124.26     1      1920     3.547  0.060
FEMALE      68.90   69.02 #       6.62 1814602.75     1      1798     0.007  0.935
NORTH       69.16   65.56 #    3171.80 1088065.09     1       981     2.860  0.091
SOUTH       69.95   73.22 #    7309.96 2781816.81     1      2737     7.192  0.007
PUBLIC      70.20   71.84 #    1991.87 3041208.63     1      2941     1.926  0.165
SEPARATE    68.04   68.97 #     167.59  845285.61     1       777     0.154  0.695
```

FIGURE 53

LEVEL C (Grade 3)

NUMBER

OBJECTIVE 3 *Reads and writes numerals. (0 - 9 999).*

TEST ITEMS

5. In the boxes below, write the numbers that your teacher tells you to write.

A. ☐ D. ☐

B. ☐ E. ☐

C. ☐

10. ______

Now look at question 10. Write the number seven hundred thirty-five--seven hundred thirty five.

Now look at question 11. Write the number nine hundred eight--nine hundred eight.

11. ______

Now look at question 12. Write the number seven thousand sixty-two--seven thousand sixty-two.

12. ______

ANALYSIS

```
 _ZONE_ONE__PUPILS_IN_1978_AND_1979_ACHIEVING_WITHIN_EACH_CATAGORY_A-D_
     CRITERION CATEGORIES FOR     GRADE:3   STRAND:1   OBJECTIVE: 3
            TOTAL NUMBER OF PUPILS:  1978 N=1912    1979 N=1810

              A: BELOW 50%      B:  50-64%        C:  65-84%       D: 85-100%
          ____1978____1979_____1978____1979_____1978____1979_____1978____1979_
NUMBER(%)   19.35    17.79     16.95    18.90      8.84     9.72    54.86   53.59
MEAN (%)    18.46    19.55     58.07    57.24     75.00    75.05    97.18   97.35

          TABLES COMPARING 1978 AND 1979 MEAN SCORES AND PROPORTIONS
   ___PROPORTION TEST___ #  ____________________F-TEST_______________________
   HO: PROPOR78=PROPOR79 #  _________SS________  _______DF______
   _T-CALC____DF____PROB_#__BETWEEN_____WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
A:   1.224  3720   0.221 #    201.92  150644.47     1       690    0.925  0.337
B:  -1.551  3720   0.121 #    116.30   24381.30     1       664    3.167  0.076
C:  -0.930  3720   0.352 #      0.24     810.05     1       343    0.104  0.748
D:   0.779  3720   0.436 #     14.48   53391.60     1      2017    0.547  0.460


   ______COMPARING_THE_MEAN_SCORES_OF_PUPILS_WITHIN_ZONE_SUBGROUPS_______
                            ____________________F-TEST TABLE_________________
GROUPS          YEARS     #  _________SS________  _______DF______
======_____1978____1979__#__BETWEEN_____WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
EARLY       73.52    73.51 #      0.13 2420199.82    1      2438    0.000  0.991
LATE        73.42    73.40 #      0.15 1105775.41    1      1204    0.000  0.990
MALE        74.30    74.83 #    133.02 1860188.64    1      1920    0.137  0.711
FEMALE      72.35    72.63 #     35.23 1730921.26    1      1798    0.037  0.848
NORTH       76.36    69.60 #  11191.51  928761.94    1       981   11.821  0.001
SOUTH       72.25    75.20 #   5980.78 2649113.83    1      2737    6.179  0.013
PUBLIC      73.40    74.21 #    484.31 2853583.91    1      2941    0.499  0.480
SEPARATE    73.19    72.02 #    267.73  740084.91    1       777    0.281  0.596
```

FIGURE 54

LEVEL C (Grade 3)

NUMBER

OBJECTIVE 4 *Identifies the number of 1 000's, 100's, 10's, 1's and tenths.*

TEST ITEMS

33. Fill in the blanks:

5 026.8 _____ hundreds _____tenths _____thousands _____ones _____tens

172.5 _____tens _____hundreds _____ones _____tenths _____ thousands

7 132.4 _____thousand _____ tens _____hundreds _____tenths _____ ones

ANALYSIS

```
 _ZONE_ONE__PUPILS_IN_1978_AND_1979_ACHIEVING_WITHIN_EACH_CATAGORY_A-D_
     CRITERION CATEGORIES FOR     GRADE:3   STRAND:1   OBJECTIVE: 4
           TOTAL NUMBER OF PUPILS:  1978 N=1912    1979 N=1810

             A: BELOW 50%       B:  50-64%        C:  65-84%        D: 85-100%
         ____1978____1979_____1978____1979_____1978____1979_____1978____1979_
NUMBER(%)   53.14    49.94      0.42     0.17    12.81    14.64    33.63    35.25
MEAN (%)     5.44     5.25     52.08    55.56    67.62    66.98    99.90    99.95

            TABLES COMPARING 1978 AND 1979 MEAN SCORES AND PROPORTIONS
    ___PROPORTION TEST___ #  ____________________F-TEST_______________________
    HO: PROPOR78=PROPOR79 #  _________SS________  ______DF______
    _T-CALC____DF____PROB_#__BETWEEN_____WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
A:    1.948   3720   0.052 #     16.12  284232.69     1      1918     0.109  0.742
B:    1.419   3720   0.156 #     26.30     150.46     1         9     1.573  0.241
C:   -1.620   3720   0.105 #     51.80    4334.91     1       508     6.071  0.014
D:   -1.039   3720   0.299 #      2.63     617.98     1      1279     5.443  0.020

     ______COMPARING_THE_MEAN_SCORES_OF_PUPILS_WITHIN_ZONE_SUBGROUPS______
                                 ____________________F-TEST TABLE_________________
GROUPS          YEARS       #  _________SS________  ______DF______
======_____1978____1979___#__BETWEEN_____WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
EARLY        46.45    48.09 #   1639.51 4860219.53     1      2438     0.822  0.365
LATE         44.17    45.86 #    860.10 2402414.78     1      1204     0.431  0.512
MALE         44.56    47.72 #   4786.64 3810951.35     1      1920     2.412  0.121
FEMALE       46.23    47.82 #   1131.24 3602093.73     1      1798     0.565  0.453
NORTH        48.43    42.49 #   8666.75 1910710.73     1       981     4.450  0.035
SOUTH        44.23    49.60 #  19733.93 5479479.18     1      2737     9.857  0.002
PUBLIC       46.67    48.76 #   3211.14 5887434.93     1      2941     1.604  0.206
SEPARATE     40.49    43.96 #   2334.48 1507893.56     1       777     1.203  0.273
```

FIGURE 55

LEVEL C (Grade 3)

NUMBER

OBJECTIVE 5 *Rewrites numbers in expanded notation (0 - 1 000) and vice versa.*

TEST ITEMS

30. Fill in the blanks:

a) 691 = 600 + ________ + 1

b) 403 = ________ + ________ + 3

c) 69 = 60 + ________

d) 919 = 900 + ________ + 9

e) 710 = 700 + ________

34. Write the number for these:

a) 1 hundred 4 tens 2 ones = ______________

b) 7 tens 3 ones = ______________

c) 8 hundreds 1 one = ______________

d) 3 hundreds 6 tens 5 ones = ______________

ANALYSIS

```
 _ZONE_ONE__PUPILS_IN_1978_AND_1979_ACHIEVING_WITHIN_EACH_CATAGORY_A-D_
      CRITERION CATEGORIES FOR     GRADE:3   STRAND:1    OBJECTIVE: 5
           TOTAL NUMBER OF PUPILS:  1978 N=1912    1979 N=1810

           A: BELOW 50%        B:  50-64%         C:  65-84%        D: 85-100%
       ____1978____1979_____1978____1979_____1978____1979_____1978____1979_
NUMBER(%)   9.73   10.17      2.04     2.93     51.10   49.67     37.13   37.24
MEAN (%)   10.75   12.71     52.14    52.93     73.22   73.09     97.28   97.07

          TABLES COMPARING 1978 AND 1979 MEAN SCORES AND PROPORTIONS
   ___PROPORTION TEST___ #  ___________________F-TEST_______________________
   HO: PROPOR78=PROPOR79 #  ________SS________  ______DF______
   _T-CALC____DF____PROB_#__BETWEEN_____WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
A:  -0.446   3720   0.656 #    354.85   87745.66     1       368    1.488   0.223
B:  -1.745   3720   0.081 #     14.32     816.00     1        90    1.579   0.212
C:   0.872   3720   0.383 #      8.61   33904.10     1      1874    0.476   0.490
D:  -0.065   3720   0.948 #     14.27   21279.33     1      1382    0.927   0.336

   _____COMPARING_THE_MEAN_SCORES_OF_PUPILS_WITHIN_ZONE_SUBGROUPS_______
                               ___________________F-TEST TABLE_________________
GROUPS         YEARS       #  ________SS________  ______DF______
======_____1978____1979___#__BETWEEN_____WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
EARLY        75.37    75.05 #     62.54 1600497.45    1      2438    0.095   0.758
LATE         76.25    75.68 #     99.59  720844.35    1      1204    0.166   0.683
MALE         75.73    76.17 #     94.97 1282524.34    1      1920    0.142   0.706
FEMALE       75.56    74.35 #    653.87 1073727.46    1      1798    1.095   0.296
NORTH        76.67    71.77 #   5882.57  588436.66    1       981    9.807   0.002
SOUTH        75.27    76.52 #   1061.80 1760784.60    1      2737    1.650   0.199
PUBLIC       76.47    75.84 #    293.30 1848663.06    1      2941    0.467   0.495
SEPARATE     72.67    73.19 #     74.56  802125.38    1       777    0.115   0.734
```

FIGURE 56

LEVEL C (Grade 3)

NUMBER

OBJECTIVE 6 *Reads and writes decimals to tenths.*

TEST ITEMS

Say, "For each of the next questions on this page, I will read a number, and I want you to write this number on the line provided. Use decimals."

Look at question 6. Write the number sixty one and nine tenths on the line--write sixty one and nine tenths in decimals.

Now look at question 7. Write the number two hundred eighty and five tenths on the line--write two hundred eighty and five tenths.

Now look at question 8. Write the number eleven and six tenths--eleven and six tenths.

Now look at question 9. Write the number ninety-eight and seven tenths on the line--ninety-eight and seven tenths.

6. ______

7. ______

8. ______

9. ______

ANALYSIS

```
 _ZONE_ONE__PUPILS_IN_1978_AND_1979_ACHIEVING_WITHIN_EACH_CATAGORY_A-D_
     CRITERION CATEGORIES FOR     GRADE:3   STRAND:1   OBJECTIVE: 6
           TOTAL NUMBER OF PUPILS:  1978 N=1912    1979 N=1810

            A: BELOW 50%       B:  50-64%        C:  65-84%         D: 85-100%
        ____1978____1979_____1978____1979_____1978____1979_____1978____1979_
NUMBER(%)  29.08    21.38     3.45     4.64    12.71    12.38    54.76    61.60
MEAN (%)    2.87     4.28    50.09    50.15    75.03    75.00   100.00    99.98

            TABLES COMPARING 1978 AND 1979 MEAN SCORES AND PROPORTIONS
   ___PROPORTION TEST___ #  ___________________F-TEST______________________
   HO: PROPOR78=PROPOR79 #  _________SS_________  ______DF______
   _T-CALC____DF____PROB_#__BETWEEN_____WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
A:   5.397   3720   0.000 #    455.74   70999.56     1      941    6.040  0.014
B:  -1.644   3720   0.065 #      0.11     192.86     1      148    0.083  0.774
C:   0.307   3720   0.759 #      0.08      38.90     1      465    0.922  0.338
D:  -4.229   3720   0.000 #      0.27     311.94     1     2160    1.880  0.171


      ______COMPARING_THE_MEAN_SCORES_OF_PUPILS_WITHIN_ZONE_SUBGROUPS_______
                            ___________________F-TEST TABLE_________________
GROUPS         YEARS       #  _________SS_________  ______DF______
======______1978____1979__#__BETWEEN_____WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
EARLY         67.80    73.07 #  16905.44 4071765.14     1     2438   10.122  0.002
LATE          65.11    75.10 #  30022.43 2045007.02     1     1204   17.676  0.000
MALE          65.27    73.92 #  35962.51 3258648.67     1     1920   21.189  0.000
FEMALE        68.57    74.32 #  14867.45 2950770.03     1     1798    9.059  0.003
NORTH         73.28    66.15 #  12449.54 1670012.95     1      981    7.313  0.007
SOUTH         64.48    76.88 # 105192.98 4475659.75     1     2737   64.329  0.000
PUBLIC        65.19    75.73 #  81647.09 4906689.62     1     2941   48.938  0.000
SEPARATE      73.08    67.93 #   8154.79 1270099.14     1      777    3.184  0.076
```

FIGURE 57

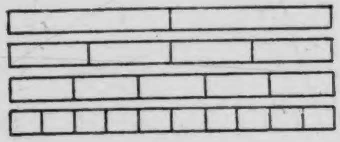
LEVEL C (Grade 3)

NUMBER

OBJECTIVE 7 *Identifies, writes and compares fractions from physical representation (halves, quarters, tenths, and fifths).*

TEST ITEMS

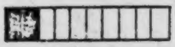
For questions 17 and 18 you can look at the diagram below. Circle the fraction which shows the greater amount.



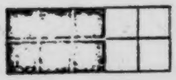
18. $\frac{5}{10}$ $\frac{2}{5}$

17. $\frac{1}{2}$ $\frac{3}{4}$

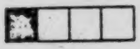
23.



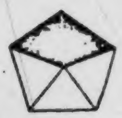
24.



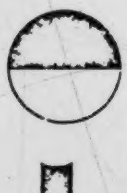
25.



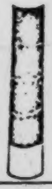
26.



27.



28.



ANALYSIS

```
_ZONE_ONE__PUPILS_IN_1978_AND_1979_ACHIEVING_WITHIN_EACH_CATAGORY_A-D_
   CRITERION CATEGORIES FOR    GRADE:3   STRAND:1   OBJECTIVE: 7
        TOTAL NUMBER OF PUPILS:  1978 N=1912    1979 N=1810

          A: BELOW 50%      B:  50-64%        C:  65-84%       D: 85-100%
        ____1978____1979_____1978____1979_____1978____1979_____1978____1979_
NUMBER(%)  16.42    13.37     8.58    8.18     42.57   40.99     32.43   37.46
MEAN (%)   27.47    25.93    55.44   54.50     76.72   76.44     97.31   97.26

            TABLES COMPARING 1978 AND 1979 MEAN SCORES AND PROPORTIONS
   ___PROPORTION TEST___ #  ____________________F-TEST______________________
   HO: PROPOR78=PROPOR79 #  ________SS________  ______DF______
   _T-CALC____DF____PROB_#__BETWEEN_____WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
A:    2.611  3720   0.009 #    323.45    98121.04     1      554     1.826  0.177
B:    0.441  3720   0.659 #     67.65     5100.40     1      310     4.111  0.043
C:    0.976  3720   0.329 #     29.73    79327.99     1     1554     0.582  0.446
D:   -3.220  3720   0.001 #      0.90    19905.37     1     1256     0.059  0.809


   ______COMPARING_THE_MEAN_SCORES_OF_PUPILS_WITHIN_ZONE_SUBGROUPS_______
                              ___________________F-TEST TABLE_________________
GROUPS       YEARS        #  ________SS________  ______DF______
======______1978____1979__#__BETWEEN_____WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
EARLY        73.24   75.57 #   3300.33 1492035.90     1     2438     5.393  0.020
LATE         74.26   74.82 #     96.22  732866.69     1     1204     0.158  0.691
MALE         72.53   74.75 #   2347.86 1194143.22     1     1920     3.775  0.052
FEMALE       74.50   76.70 #   2168.88 1065050.41     1     1798     3.661  0.056
NORTH        77.12   72.60 #   5016.67  536927.13     1      981     9.166  0.003
SOUTH        72.14   76.77 #  14678.33 1710456.28     1     2737    23.488  0.000
PUBLIC       73.42   76.34 #   6240.93 1858252.36     1     2941     5.877  0.002
SEPARATE     73.71   73.23 #     44.34  401630.35     1      777     0.086  0.770
```

FIGURE 58

All four of the objectives dealing with place-value related knowledge had rather low achievement ratings. About fifty percent of the pupils in 1978 and 1979 could not identify the numbers of 1000's, 100's, 10's, 1's and tenths in numbers. Mean scores for all sub-groups were below the 50 percent level. Somewhat better performance was recorded for reading and writing the numerals 0-999 and decimals to tenths. From fifty to sixty percent of the pupils in 1978 and 1979 could handle these reading and writing skills to the 85-100 percent level. About one in five could not. Over eighty-five percent of the pupils could rewrite numerals in expanded notations (0-1000) and vice versa to the C and D achievement levels (65-100 percent). Half of this group were in category C, however.

Pupils did moderately well at identifying, writing and comparing fractions (halves, quarters, fifths and tenths). The proportion of grade three's achieving in category D increased significantly for this skill in 1979. Sub-group means reached the 75 percent level and the largest proportion of pupils, was in the 65-84 percent level.

OPERATIONS AND PROPERTIES (Nine objectives; Figures 59 to 67)

Hypothesis 1

None of the objectives had performances where eighty percent Zone One pupils in 1978 and 1979 were at the 85-100 percent achievement level.

Hypothesis 2

There were no significant increases in the proportion of pupils achieving within category D (85-100 percent) from 1978 to 1979.

Findings

About one quarter of the Zone One pupils in 1979 could identify all four additive, subtractive, multiplicative and division situations. Sub-group means for this skill ranged from 65 to 69 percent.

At least two-thirds of the pupils could add and subtract two and three digit numbers within categories C and D (65-100 percent).

Most Zone One pupils can symbolize multiplication and division situations. About seventy percent of the grade three group worked to the 100 percent level.

Pupils did have difficulty with identifying related sentences for the four operations. Only twenty-eight percent of the group were in category D (85-100) on this skill and over thirty percent of the 1979 pupils were at or below 64 percent.

Pupil understanding of the unique affect of 0 and 1 in addition and multiplication respectively was somewhat low. Thirty-eight percent of the students were in the 85-100 percent level while approximately the same number had marks of 64 percent or less.

Performance on the basic facts in the four operations to 18 was low. The test item checked for both speed and

LEVEL C (Grade 3)

OPERATIONS AND PROPERTIES

OBJECTIVE 1 *Identifies additive, subractive, multiplicative and divisive situations.*

TEST ITEMS

44. Put a check mark (✓) in the box that tells you what to do to find the answer to each problem.

A. Bill had 11 marbles. There was a hole in his bag. He lost 6 of them. How many marbles has he left?
☐ Add
☐ Subtract
☐ Multiply
☐ Divide

B. Patti picked 12 flowers. She put 4 flowers in each vase. How many vases did she use?
☐ Add
☐ Subtract
☐ Multiply
☐ Divide

C. There were 8 books on a shelf. Chris put 3 more books on the shelf. How many books are on the shelf now?
☐ Add
☐ Subtract
☐ Multiply
☐ Divide

D. The class lined up by twos. There are 9 groups of two. How many children were there?
☐ Add
☐ Subtract
☐ Multiply
☐ Divide

3. Watch your teacher. Put a check mark (✓) in the box that tells what she is doing.

1. Watch your teacher. Put a check mark (✓) in the box that tells what she is doing.
☐ Add ☐ Multiply
☐ Subtract ☐ Divide

ANALYSIS

```
 PUPILS IN 1978 AND 1979 ACHIEVING WITHIN EACH CATAGCRY A-D
_ZONE ONE__PUPILS_IN_1978_AND_1979_ACHIEVING_WITHIN_EACH_CATAGCRY_A-D_
     CRITERION CATEGCRIES FOR      GPADE:3    STRAND:2   OBJECTIVE: 1
          TOTAL NUMBER OF PUPILS:   1978 N=1912    1979 N=1810

                                                C:  65-84%         D: 85-100%
           A: BELOW 50%        B:  50-64%     _1978____1979_____1978____1979_
       ____1978____1979_____1978____1979____ 37.34    36.57     28.45    25.69
NUMBER(%)  14.33    16.80     19.87    20.94     74.86    74.51     97.72    97.85
MEAN (%)   30.93    29.93     53.29    53.08

             TABLES COMPARING 1978 AND 1979 MEAN SCORES AND PROPORTIONS
                                  ____________________F-TEST______________________
   ___PROPORTION TEST___  #  ____________________  ______DF______
   HO: PROPOR78=PROPOR79  #  ________SS________    BETWEEN_WITHIN__F-RATIO__PROB
   _T-CALC____DF____PROB_#__BETWEEN_____WITHIN__BETWEEN_WITHIN  0.898    0.344
                                143.09    91780.81     1        576    0.515    0.473
A:  -2.075   3720   0.038 #       8.46    12435.72     1        757    0.777    0.378
B:  -0.806   3720   0.421 #      42.29    74757.00     1       1374    0.321    0.571
C:   0.485   3720   0.627 #       4.36    13695.94     1       1007
D:   1.894   3720   0.058 #

           COMPARING THE MEAN SCCRES OF PUPILS WITHIN ZONE SUBGROUPS_______
     ______COMPARING_THE_MEAN_SCCRES_OF_PUPILS_WITHIN_ZONE_SUBGROUPS_______
                                  __________________F-TEST TABLE_________________
                          #   ____________________  ______DF______
GROUPS          YEARS     #   ________SS________    BETWEEN_WITHIN__F-RATIO__PROB
======_____1978____1979__#__BETWEEN_____WITHIN__BETWEEN_WITHIN    3.124    0.077
                                                         2438
EARLY       70.22    68.46 #   1874.55 1462797.32     1     1204   11.348    0.001
LATE        71.96    67.58 #   5775.26  612718.21     1     1920    3.453    0.063
MALE        69.59    67.51 #   2077.72 1155409.31     1     1798    5.047    0.025
FEMALE      72.06    69.62 #   2686.51  957033.24     1      981   14.749    0.000
NORTH       72.00    65.99 #   8847.22  588462.60     1     2737    1.033    0.310
SOUTH       70.33    69.42 #    574.85 1523806.82     1     2941   13.892    0.000
PUBLIC      72.00    68.73 #   7866.47 1665338.79     1      777    0.815    0.367
SEPARATE    66.21    67.76 #    462.84  441069.40     1
```

FIGURE 59

LEVEL C (Grade 3)

OPERATIONS AND PROPERTIES

OBJECTIVE 2 *Adds and subtracts two or three digit numbers with and without regrouping.*

TEST ITEMS

41. Add:

814 + 107	726 + 176	439 + 272

42. Subtract:

662 - 524	426 - 131	834 - 246

43. Answer the following:

26 - 14	389 + 412	682 - 216
92 + 16	64 - 25	461 + 248

ANALYSIS

```
ZONE ONE  PUPILS IN 1978 AND 1979 ACHIEVING WITHIN EACH CATAGCRY A-D
     CRITERION CATEGCRIES FOR     GRADE:3    STRAND:2    OBJECTIVE: 2
          TOTAL NUMBER OF PUPILS:  1978 N=1912    1979 N=1810

                                                              D: 85-100%
           A: BELOW 50%      B:  50-64%         C:  65-84%     1978    1979
       ____1978____1979_____1978____1979_____1978____1979____  42.89   41.10
NUMBER(%)  14.54   17.51    15.12   15.25     27.46   26.13     96.15   96.25
MEAN (%)   23.02   24.87    54.99   54.66     76.95   76.51

          TABLES COMPARING 1978 AND 1979 MEAN SCORES AND PROPORTIONS
                                 #  _____________________F-TEST_____________________
   ___PROPORTION TEST___         #  ________SS________   ______DF______
   HO: PRCPOR78=PROPOR79         #  BETWEEN_____WITHIN  BETWEEN WITHIN__F-RATIO__PROB
   _T-CALC____DF____PROB_        #   505.25  123871.67    1       593     2.419   0.120
A:  -2.475   3720   0.014        #    14.78    9597.43    1       563     0.867   0.352
B:  -0.113   3720   0.910        #    49.50   43470.68    1       996     1.134   0.287
C:   0.912   3720   0.362        #     4.30   26888.05    1      1562     0.250   0.617
D:   1.101   3720   0.271        #

           COMPARING THE MEAN SCORES OF PUPILS WITHIN ZONE SUBGROUPS______
      _________________________________F-TEST TABLE_________________________
                               #  ___________________
GROUPS        YEARS            #  ________SS________   ______DF______
======_____1978____1979__#__BETWEEN_____WITHIN__BETWEEN WITHIN__F-RATIO__PROB
                               #   657.66 1801414.85   1      2438     0.890   0.346
EARLY       73.69   72.65      #  4716.88  819078.84   1      1204     6.934   0.009
LATE        75.15   71.19      #   131.52 1527111.06   1      1920     0.165   0.684
MALE        70.11   69.59      #  4464.58 1099631.67   1      1798     7.300   0.007
FEMALE      78.23   75.08      #  4234.30  756230.33   1       981     5.493   0.019
NORTH       73.74   69.58      #   621.32 1911067.38   1      2737     0.890   0.346
SOUTH       74.13   73.18      #  4457.53 2025171.40   1      2941     6.473   0.011
PUBLIC      75.12   72.65      #   110.46  637001.89   1       777     0.135   0.714
SEPARATE    69.95   70.70      #
```

FIGURE 60

LEVEL C (Grade 3)

OPERATIONS AND PROPERTIES

OBJECTIVE 3 *Symbolizes multiplication and division situations.*

TEST ITEMS

39. Put the correct sign in the box (+ - ÷ x)

3 ☐ 3 = 9

7 ☐ 4 = 11

18 ☐ 2 = 9

11 ☐ 8 = 3

ANALYSIS

```
ZONE_ONE__PUPILS_IN_1978_AND_1979_ACHIEVING_WITHIN_EACH_CATAGCRY_A-D_
  CRITERION CATEGORIES FOR     GRADE:3   STRAND:2   OBJECTIVE: 3
        TOTAL NUMBER OF PUPILS:  1978 N=1912    1979 N=1810

                                                          D: 85-100%
            A: BELOW 50%      B:  50-64%  .    C:  65-84%
                                              1978____1979_____1978____1979_
        ____1978____1979_____1978____1979_____12.45    12.82     68.57    69.72
NUMBER(%)    8.00     8.73    10.98     8.73    75.00    75.00    100.00   100.00
MEAN (%)    12.09    10.92    50.00    50.00

          TABLES CCMPARING 1978 AND 1979 MEAN SCORES AND PROPORTIONS
                                   ______________________F-TEST______________________
   ___PROPORTION TEST___ #  ____________________   ______DF______
   HO: PRCPOR78=PROPOR79 #  ________SS________   BETWEEN_WITHIN__F-RATIO__PROB
   _T-CALC____DF____PROB_#__BETWEEN______WITHIN_      1        309      0.687   0.408
A:   -0.801   3720   0.423 #    107.09   48172.65
B:    2.303   3720   0.021 #  <<<<<<<<<<<<<< SSW IS EQUAL TC ZERO >>>>>>>>>>>>>>
C:   -0.340   3720   0.734 #  <<<<<<<<<<<<<< SSW IS EQUAL TO ZERO >>>>>>>>>>>>>>
D:   -0.764   3720   0.445 #  <<<<<<<<<<<<<< SSW IS EQUAL TC ZERO >>>>>>>>>>>>>>

       ______CCMPARING_THE_MEAN_SCORES_OF_PUPILS_WITHIN_ZONE_SUBGROUPS______
                               ____________________F-TEST TABLE_________________
                               ____________________  ______DF______
GROUPS          YEARS        #  ________SS________   BETWEEN_WITHIN__F-RATIO__PROB
======_____1978____1979__#__BETWEEN______WITHIN_      1        2438     0.431   0.511
EARLY       83.80    84.55 #    340.66 1924937.01      1        1204     0.713   0.399
LATE        85.61    84.33 #    492.52  831607.40      1        1920     0.557   0.456
MALE        84.70    83.74 #    435.39 1501890.31      1        1798     1.629   0.202
FEMALE      84.00    85.62 #   1178.18 1300618.70      1         981     0.079   0.779
NORTH       82.17    81.64 #     69.49  866640.83      1        2737     0.275   0.600
SOUTH       85.17    85.70 #    193.53 1928568.79      1        2941     0.000   0.992
PUBLIC      84.80    84.81 #      0.08 2175935.61      1         777     0.427   0.513
SEPARATE    82.74    84.07 #    344.80  626875.99
```

FIGURE 61

OPERATIONS AND PROPERTIES

LEVEL C (Grade 3)

OBJECTIVE 4 *Identifies related sentences for addition, subtraction, multiplication and division.*

TEST ITEMS

38. Circle the two number sentences that tell the same story.

a) 3 + 3 = 6

b) 6 x 3 = 18

c) 2 x 3 = 6

d) 6 - 3 = 3

45. Write the correct number sentence or equation for each problem.

A. There were 15 trees. A man cut down 9 of them. How many were left?

____ ____ = ____

B. There were 12 birds on a branch. They flew away in groups of threes. How many groups were there?

____ ____ = ____

C. Bill has 3 boxes of marbles. There are 5 marbles in each box. How many marbles has he?

____ ____ = ____

D. In our room there are 13 boys and 16 girls. How many children are in our class?

____ ____ = ____

ANALYSIS

```
        _ZONE_ONE__PUPILS_IN_1978_AND_1979_ACHIEVING_WITHIN_EACH_CATAGORY_A-D_
             CRITERION CATEGCRIES FOR      GRADE:3    STRAND:2    OBJECTIVE: 4
                  TOTAL NUMBER OF PUPILS:  1978 N=1912    1979 N=1810

              A: BELOW 50%        B:  50-64%          C:  65-84%          D: 85-100%
          ____1978____1979_____1978____1979_____1978____1979_____1978____1979_
NUMBER(%)  18.99     18.73     11.61     13.76     40.32     38.73      29.08    28.78
MEAN (%)   22.36     22.98     50.71     50.33     74.91     75.12      99.66    99.82

                 TABLES COMPARING 1978 AND 1979 MEAN SCORES AND PROPORTIONS
    ___PROPORTION TEST___  #  ____________________F-TEST________________________
    HO: PROPOR78=PROPOR79  #  ________SS________  ______DF______
    _T-CALC____DF____PROB_#__BETWEEN_____WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
A:    0.200   3720    0.842 #     68.32  133939.77     1        700     0.357  0.550
B:   -1.968   3720    0.049 #     16.82    1873.07     1        469     4.211  0.041
C:    0.995   3720    0.320 #     15.48  100817.66     1       1470     0.226  0.635
D:    0.198   3720    0.843 #      7.66    2278.91     1       1075     3.614  0.058


    _____COMPARING_THE_MEAN_SCORES_OF_PUPILS_WITHIN_ZONE_SUBGROUPS_______
                               ____________________F-TEST TABLE___________________
GROUPS          YEARS       #  ________SS________  ______DF______
======_____1978____1979__#__BETWEEN_____WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
EARLY       69.05    68.83 #     27.93 1990574.04     1       2438     0.034  0.853
LATE        70.06    68.55 #    683.17  930990.00     1       1204     0.884  0.347
MALE        68.04    68.65 #    180.35 1652033.53     1       1920     0.210  0.647
FEMALE      70.70    69.49 #    660.83 1322138.20     1       1798     0.899  0.343
NORTH       70.59    62.42 #  16368.33  877310.46     1        981    18.303  0.000
SOUTH       68.85    71.36 #   4320.57 2071690.96     1       2737     5.708  0.017
PUBLIC      69.83    69.42 #    125.92 2398104.62     1       2941     0.154  0.694
SEPARATE    67.41    67.67 #     12.89  876971.67     1        777     0.017  0.895
```

FIGURE 62

OPERATIONS
AND PROPERTIES

LEVEL C (Grade 3)

OBJECTIVE 5 *Understands the basis of the commutative property of addition and multiplication.*

TEST ITEMS

31. Fill in the missing number:

a) 128 + 420 = ________ + 128

b) 1 246 + ________ = 648 + 1 246

c) ________ + 948 = ________ + 326

35. Fill in the blank with the correct shape.

A.

△ + □ = ○

□ + ___ = ○

B.

$a \times b = c$

$b \times \_\_\_ = c$

ANALYSIS

```
_ZONE_ONE__PUPILS_IN_1978_AND_1979_ACHIEVING_WITHIN_EACH_CATAGCRY_A-D_
     CRITERION CATEGCRIES FOR     GRADE:3   STRAND:2   CBJECTIVE: 5
          TOTAL NUMBER OF PUPILS:  1978 N=1912    1979 N=1810

             A: BELOW 50%       B:  50-64%      C:  65-84%        D: 85-100%
                                               1978____1979______1978____1979_
          ____1978____1979_____1978____1979_____44.56   39.94    43.68   51.71
NUMBER(%)   10.20     7.29      1.36    1.05
MEAN (%)    17.95    16.29     50.00   50.00    71.30   71.00   100.00  100.00

            TABLES COMPARING 1978 AND 1979 MEAN SCORES AND PROPORTIONS
    ___PROPORTION TEST___ #  ____________________F-TEST_______________________
    HO: PRCPOR78=PROPOR79 #  ________SS________  ______DF______
    _T-CALC____DF____PROB_#__BETWEEN_____WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
A:    3.130   3720   ).002 #   217.13   82993.88    1       325    0.850  0.357
B:    0.865   3720   0.387 # <<<<<<<<<<<<<< SSW IS EQUAL TC ZERC >>>>>>>>>>>>>>
C:    2.849   3720   0.004 #    35.75   86163.54    1      1573    0.653  0.419
D:   -4.781   3720   0.000 # <<<<<<<<<<<<<< SSW IS EQUAL TC ZERC >>>>>>>>>>>>>>

      ______COMPARING_THE_MEAN_SCCRES_OF_PUPILS_WITHIN_ZONE_SUBGROUPS_______
    _____________________________________F-TEST TABLE___________________
                                ____________________
GROUPS         YEARS        #  ________SS________  ____+__DF______
======_____1978____1979__#__BETWEEN_____WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
                                                           2438   17.795  0.000
EARLY         77.66    82.00 #  11440.72 1567458.98   1     1204    0.223  0.637
LATE.         79.82    80.48 #    129.74  700079.63   1     1920   10.367  0.001
MALE          76.55    80.38 #   7056.22 1306871.98   1     1758    9.215  0.003
FEMALE        79.90    83.28 #   5130.66 1001065.48   1      981    1.597  0.207
NORTH         78.55    76.34 #   1202.32  738691.43   1     2737   38.486  0.000
SOUTH         78.02    83.68 #  21930.33 1559601.25   1     2941   15.267  0.000
PUBLIC        78.15    81.73 #   9427.44 1816073.94   1      777    4.315  0.038
SEPARATE      78.22    82.40 #   2782.01  500983.50   1
```

FIGURE 63

LEVEL C (Grade 3)

OPERATIONS AND PROPERTIES

OBJECTIVE 6 *Understands the unique effect of 0 and 1 in addition and multiplication respectively.*

TEST ITEMS

13. When 1 is added to a number the answer is:
   - ☐ One less than the number.
   - ☐ The same as the number.
   - ☐ 1
   - ☐ One more than the number.

14. When a number is multiplied by 1, the answer is:
   - ☐ The same as the number.
   - ☐ 0
   - ☐ 1
   - ☐ One more than the number.

15. When a number is added to 0 the answer is:
   - ☐ The same as the number.
   - ☐ One more than the number.
   - ☐ 0
   - ☐ One less than the number.

16. When a number is multiplied by 0, the answer is:
   - ☐ The same as the number.
   - ☐ One more than the number.
   - ☐ 0
   - ☐ One less than the number.

ANALYSIS

```
 _ZONE_ONE__PUPILS_IN_1978_AND_1979_ACHIEVING_WITHIN_EACH_CATAGORY_A-D_
     CRITERION CATEGORIES FOR     GRADE:3   STRAND:2   OBJECTIVE: 6
          TOTAL NUMBER OF PUPILS:  1978 N=1912    1979 N=1810

          A: BELOW 50%      B: 50-64%        C:  65-84%        D: 85-100%
                                                            1978____1979_
       ____1978____1979____1978____1979_____1978____1979_____42.15   38.51
NUMBER(%)  15.48   15.14   19.40   20.94    22.96   25.41    99.98   99.96
MEAN (%)   19.21   18.29   50.00   50.03    75.00   75.00

          TABLES COMPARING 1978 AND 1979 MEAN SCORES AND PROPORTIONS
   ___PROPORTION TEST___ #  ___________________F-TEST_____________________
   HO: PROPOR78=PROPOR79 #  ________SS________  ______DF______
   _T-CALC____DF____PROB_#__BETWEEN_____WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
A:    0.290  3720   0.772 #   120.62   66832.23    1       568     1.025  0.312
B:   -1.167  3720   0.244 #     0.20     155.84    1       748     0.979  0.323
C:   -1.748  3720   0.081 # <<<<<<<<<<<<<< SSW IS EQUAL TO ZERO >>>>>>>>>>>>>>
D:    2.266  3720   0.024 #     0.15     467.66    1      1501     0.497  0.481

   ______COMPARING_THE_MEAN_SCORES_OF_PUPILS_WITHIN_ZONE_SUBGROUPS_______
                            ____________________F-TEST TABLE__________________
GROUPS         YEARS      #  ________SS________  ______DF______
======______1978____1979__#__BETWEEN_____WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
EARLY        70.68   70.66 #      0.15 2145682.16     1      2438     0.000  0.989
LATE         74.76   70.44 #   5615.71 1022356.54     1      1204     6.613  0.010
MALE         70.06   70.05 #      0.07 1716481.13     1      1920     0.000  0.993
FEMALE       74.17   71.60 #   2983.42 1501079.08     1      1798     3.574  0.059
NORTH        75.87   67.99 #  15240.88  835390.48     1       981    17.897  0.000
SOUTH        70.63   71.78 #    904.02 2375979.53     1      2737     1.041  0.308
PUBLIC       72.88   70.30 #   4807.37 2515204.84     1      2941     5.621  0.018
SEPARATE     69.03   72.73 #   2669.44  705073.26     1       777     2.942  0.087
```

FIGURE 64

OPERATIONS AND PROPERTIES

LEVEL C (Grade 3)

OBJECTIVE 7 *Demonstrates mastery of basic facts involving sums, minuends, products and dividends to 18.*

TEST ITEMS

29. On this page you are to do some basic facts quickly. Start when your teacher says "Go" and stop when she says "Stop."

6 + 2 = ________

4 x 4 = ________

14 ÷ 7 = ________

18 - 5 = ________

9 ÷ 3 = ________

6 x 2 = ________

9 + 9 = ________

12 - 9 = ________

16 ÷ 8 = ________

8 x 2 = ________

4 + 11 = ________

8 + 7 = ________

10 ÷ 5 = ________

15 - 8 = ________

11 - 6 = ________

18 ÷ 3 = ________

5 x 3 = ________

2 x 5 = ________

16 ÷ 4 = ________

6 + 8 = ________

10 ÷ 2 = ________

9 x 2 = ________

3 x 3 = ________

18 ÷ 2 = ________

ANALYSIS

```
 _ZONE_ONE__PUPILS_IN_1978_AND_1979_ACHIEVING_WITHIN_EACH_CATAGORY_A-D_
     CRITERION CATEGORIES FOR    GRADE:3   STRAND:2   OBJECTIVE: 7
          TOTAL NUMBER OF PUPILS:  1978 N=1912   1979 N=1810

          A: BELOW 50%      B:  50-64%        C:  65-84%        D: 85-100%
      ____1978____1979_____1978____1979_____1978____1979_____1978____1979_
NUMBER(%)  25.58   27.46    16.42   16.80    19.72   19.72    38.28   36.02
MEAN (%)   29.17   29.69    56.24   56.95    75.96   75.50    95.29   95.13

          TABLES COMPARING 1978 AND 1979 MEAN SCORES AND PROPORTIONS
  ___PROPORTION TEST___ #  ___________________F-TEST_______________________
  HO: PROPOR78=PROPOR79 #  _________SS_________  ______DF______
  _T-CALC____DF____PROB_#__BETWEEN_______WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
A:   -1.301  3720   0.194 #     68.76  163906.49     1       984     0.413  0.521
B:   -0.306  3720   0.760 #     78.36   13471.20     1       616     3.583  0.059
C:   -0.005  3720   0.996 #     38.74   27339.30     1       732     1.037  0.309
D:    1.427  3720   0.154 #      9.07   27606.12     1      1382     0.454  0.501


  ______COMPARING_THE_MEAN_SCORES_OF_PUPILS_WITHIN_ZONE_SUBGROUPS______
                                ___________________F-TEST TABLE__________________
GROUPS          YEARS      #  _________SS_________  ______DF______
======______1978____1979__#__BETWEEN______WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
EARLY         67.47   67.23 #     35.35 1901095.00     1      2438     0.045  0.831
LATE          69.71   65.72 #   4778.44  885395.63     1      1204     6.498  0.011
MALE          66.30   64.65 #   1320.93 1561515.95     1      1920     1.624  0.203
FEMALE        70.14   69.25 #    359.13 1268273.50     1      1798     0.509  0.476
NORTH         68.55   64.53 #   3967.05  779695.28     1       981     4.991  0.026
SOUTH         68.01   67.70 #     67.10 2063105.38     1      2737     0.089  0.766
PUBLIC        68.78   67.21 #   1827.29 2227791.59     1      2941     2.412  0.121
SEPARATE      65.81   65.62 #      6.90  618041.41     1       777     0.009  0.926
```

FIGURE 65

LEVEL C (Grade 3)

OPERATIONS AND PROPERTIES

OBJECTIVE 8 *Multiplies whole numbers by 10 and 100.*

TEST ITEMS

40. Put a check mark (✓) in the box in front of the correct answer.

a) 4 x 10 = ☐ 400
☐ 40
☐ 4 000
☐ 04

b) 100 x 7 = ☐ 7 000
☐ 700
☐ 70
☐ 70 000

c) 2 x 100 = ☐ 200
☐ 2 000
☐ 20
☐ 2

d) 6 x 10 = ☐ 6 000
☐ 60
☐ 600
☐ 6

ANALYSIS

```
 _ZONE_ONE__PUPILS_IN_1978_AND_1979_ACHIEVING_WITHIN_EACH_CATAGORY_A-D_
   CRITERION CATEGORIES FOR    GRADE:3   STRAND:2   OBJECTIVE: 8
        TOTAL NUMBER OF PUPILS:  1978 N=1912    1979 N=1810

            A: BELOW 50%        B:  50-64%        C:  65-84%        D: 85-100%
          ____1978____1979_____1978____1979_____1978____1979_____1978____1979_
NUMBER(%)   10.04     8.78      9.47     9.12     13.28    15.36    67.21    66.74
MEAN (%)    10.16     8.02     50.00    50.00     75.00    75.00   100.00   100.00

          TABLES COMPARING 1978 AND 1979 MEAN SCORES AND PROPORTIONS
                                 #  _____________________F-TEST_______________________
   ___PROPORTION TEST___         #  _________SS_________  ______DF______
   HO: PROPOR78=PROPOR79         #  BETWEEN______WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
   _T-CALC____DF____PROB_        #   397.33   50596.26      1      349     2.741   0.099
A:    1.312   3720   0.190       #  <<<<<<<<<<<<<< SSW IS EQUAL TO ZERO >>>>>>>>>>>>>>
B:    0.368   3720   0.713       #  <<<<<<<<<<<<<< SSW IS EQUAL TO ZERO >>>>>>>>>>>>>>
C:   -1.807   3720   0.071       #  <<<<<<<<<<<<<< SSW IS EQUAL TC ZERO >>>>>>>>>>>>>>
D:    0.303   3720   0.762       #

       ______COMPARING_THE_MEAN_SCORES_OF_PUPILS_WITHIN_ZONE_SUBGROUPS_______
                                     ____________________F-TEST TABLE__________________
                                 #  _________SS_________  ______DF______
GROUPS          YEARS            #  BETWEEN______WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
======_____1978____1979__        #
EARLY      81.91    82.97        #   690.77  2125042.84     1     2438     0.792   0.373
LATE       85.37    83.90        #   647.03   909313.58     1     1204     0.857   0.355
MALE       81.94    83.13        #   672.11  1741939.75     1     1920     0.741   0.390
FEMALE     83.98    83.94        #     0.53  1349921.35     1     1798     0.001   0.979
NORTH      83.96    81.53        #  1450.06   883000.60     1      981     1.611   0.205
SOUTH      82.54    84.21        #  1920.54  2207869.07     1     2737     2.381   0.123
PUBLIC     83.52    83.89        #    97.32  2400968.35     1     2941     0.119   0.730
SEPARATE   80.69    82.13        #   403.42   689699.27     1      777     0.454   0.500
```

FIGURE 66

LEVEL C (Grade 3)

OPERATIONS AND PROPERTIES

OBJECTIVE 9 *Solves word problems. Estimates Answers.*

TEST ITEMS

46. Put a check mark (✓) in the box that you believe is closest to the right answer to the following problem.

Billy lives 15 blocks from school. He knows that he can walk 2 blocks in 5 minutes. If he must be at school in 10 minutes will he:

☐ get there with some time left over.
☐ get there right on time.
☐ would not have enough time to get there.

47. There are 4 birds on a fence. Then 5 birds came and sat on the fence beside them. How many birds are sitting on the fence now?

Give the number sentence or equation and solve.

48. Betty had some money in her bank. Grandmother gave her 5 dollars.

Now Betty has 8 dollars.

How much had she before Grandmother gave her the 5 dollars?

Write a number sentence or equation and solve.

49. Chris has a large fish tank. One day he took all the fish and put them in 3 smaller tanks. Now there are 5 fish in each of the 3 smaller tanks. How many fish were in the large aquarium?

Write a number sentence or equation and solve the problem.

ANALYSIS

```
   _ZONE_ONE__PUPILS_IN_1978_AND_1979_ACHIEVING_WITHIN_EACH_CATAGCRY_A-D_
        CRITERION CATEGCRIES FOR     GRADE:3    STRAND:2    OBJECTIVE: 9
             TOTAL NUMBER OF PUPILS:   1978 N=1912     1979 N=1810

            A: BELOW 50%        B:  50-64%          C:  65-84%         D: 85-100%
        ____1978____1979_____1978____1979_____1978____1979_____1978____1979_
NUMBER(%)   31.59   33.48    26.67   29.67    22.12   19.28    19.61   17.57
MEAN (%)    20.18   22.03    53.26   53.65    74.82   75.04    96.35   96.44

          TABLES CCMPARING 1978 AND 1979 MEAN SCCRES AND PROPCRTIONS
    ___PROPORTION TEST___ #  ___________________F-TEST_____________________
    HC: PRCPOR78=PROPOR79 #  _________SS________  ______DF______
    _T-CALC____DF____PRCB_#__BETWEEN______WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
A:   -1.231   3720   0.219 #   1037.23  159749.96      1     1208    6.273   0.012
B:   -2.031   3720   0.042 #     40.76   32486.62      1     1045    1.311   0.252
C:    2.137   3720   0.033 #      8.69     533.13      1      770   12.545   0.000
D:    1.601   3720   0.110 #      1.48   22073.52      1      691    0.046   0.830

     ______CCMPARING_THE_MEAN_SCORES_OF_PUPILS_WITHIN_ZONE_SUBGROUPS_______
     _____________________________________F-TEST TABLE_____________________
                              #  _________SS________  ______DF______
GROUPS        YEARS           #  _________SS________  ______DF______
======______1978____1979__#__BETWEEN______WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
EARLY         56.50   54.37 #   2743.14 2138609.25     1     2438    3.127   0.077
LATE          55.35   54.73 #    114.05  946423.83     1     1204    0.145   0.703
MALE          55.20   54.96 #     27.64 1653432.13     1     1920    0.032   0.858
FEMALE        56.93   54.44 #   2779.34 1484987.24     1     1798    3.365   0.067
NORTH         58.22   50.71 #  13844.33  868925.57     1      981   15.630   0.000
SOUTH         55.22   56.10 #    525.45 2257589.65     1     2737    0.637   0.425
PUBLIC        56.80   55.10 #   2106.43 2514736.10     1     2941    2.463   0.117
SEPARATE      53.17   53.18 #      0.03  619949.03     1      777    0.000   0.995
```

FIGURE 67

accuracy and only thirty-six percent of the 1979 pupils responded at the 85-100 percent level. Forty-three percent of the pupils in both testing years had achievement scores at or below 64 percent.

Very poor results were found for solving word problems and estimating answers. More than sixty percent of the Zone One population received scores at or below the 64 percent figure. All sub-groups had achievement means at the mid-50 percent level.

MEASUREMENT (Nine objectives; Figures 68 to 76)

Hypothesis 1

One objective in measurement had performances whereby eighty percent of the Zone One pupils in 1978 and 1979 were in the 85-100 percent achievement category.

Hypothesis 2

Two objectives had significant increases in the proportions of students achieving at the 85-100 percent criterion in 1979 over 1978.

Findings

About three-quarters of the pupils in 1978 and 1979 could tell and write time to the nearest hour, half hour and quarter hour with 100 percent accuracy. Pupils improved significantly in 1979 in being able to write the months of the year in order. The achievement figures for this skill were much the same as those for time. Two thirds of the students could use the terms noon, midnight, a.m., and p.m.

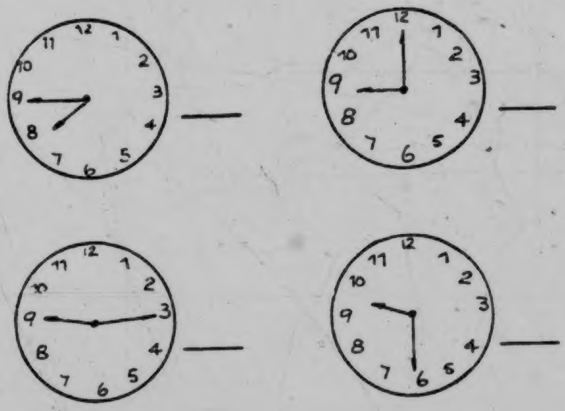
LEVEL C (Grade 3)

MEASUREMENT

OBJECTIVE 1 *Tells and writes the time to the nearest hour, half hour, quarter hour and five minute intervals.*

TEST ITEMS

12. Put the correct letter by the clock to match the time.



a. 9:15

b. 7:45

c. 9:30

d. 9 o'clock

ANALYSIS

```
_ZONE_ONE__PUPILS_IN_1978_AND_1979_ACHIEVING_WITHIN_EACH_CATAGORY_A-D_
   CRITERION CATEGCRIES FOF     GRADE:3   STRAND:3   OEJECTIVE: 1
         TOTAL NUMBER OF PUPILS:  1978 N=1912   1979 N=1810

          A: BELOW 50%       B:  50-64%         C:  65-84%        D: 85-100%
       ____1978____1979_____1978____1979_____1978____1979_____1978____1979_
NUMBER(%)  11.24    10.88     9.68     9.39     4.71     3.26    74.37    76.46
MEAN (%)   10.00     7.61    50.00    50.00    75.00    75.00   100.00   100.00

            TABLES COMPARING 1978 AND 1979 MEAN SCORES AND PROPCFTIONS
   ___PROPCRTION TEST___ #  ____________________F-TEST______________________
   HO: PRCPOR78=PROPOR79 #  _________SS________  _______DF______
   _T-CALC____DF____PROB_#__BETWEEN_____WITHIN__BETWEEN_WITHIN__F-RATIC__PROB
A:   0.351   3720   0.726 #   585.15   58328.68    1      410     4.113  0.043
B:   0.294   3720   0.769 #  <<<<<<<<<<<<<< SSW IS EQUAL TC ZERO >>>>>>>>>>>>>>
C:   2.251   3720   0.024 #  <<<<<<<<<<<<<< SSW IS EQUAL TC ZERO >>>>>>>>>>>>>>
D:  -1.481   3720   0.139 #  <<<<<<<<<<<<<< SSW IS EQUAL TC ZERO >>>>>>>>>>>>>>

   ______COMPARING_THE_MEAN_SCORES_OF_PUPILS_WITHIN_ZONE_SUBGROUPS______
                            ___________________F-TEST TABLE_________________
GROUPS          YEARS      #  _________SS________  _______DF______
======_____1978____1979__#__BETWEEN_____WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
EARLY      83.82   83.59 #     32.49 2376150.91    1     2438     0.033  0.855
LATE       84.28   86.39 #   1331.36 1048783.17    1     1204     1.528  0.217
MALE       83.46   83.56 #      4.54 1874659.87    1     1920     0.005  0.946
FEMALE     84.30   85.36 #    509.17 1649057.15    1     1798     0.555  0.456
NORTH      85.56   83.03 #   1571.64  862324.60    1      981     1.788  0.182
SOUTH      83.24   84.92 #   1941.11 2659931.83    1     2737     1.997  0.158
PUBLIC     84.17   84.69 #    197.79 2755489.44    1     2941     0.211  0.646
SEPARATE   82.74   83.47 #    104.07  768945.95    1      777     0.105  0.746
```

FIGURE 68

LEVEL C (Grade 3)

MEASUREMENT

OBJECTIVE 2 *Knows the months of the year in order.*

TEST ITEMS

3. Rewrite these months in order: July, June, September, November, January, April, December, March, August, February, May, October.

January, ____________, ____________, ____________,

____________, ____________, ____________,

____________, ____________, ____________,

____________, ____________

ANALYSIS

```
 _ZONE_ONE__PUPILS_IN_1978_AND_1979_ACHIEVING_WITHIN_EACH_CATAGCRY_A-D_
     CRITERION CATEGCRIES FOR     GRADE:3   STRAND:3   OBJECTIVE: 2
          TOTAL NUMBER OF PUPILS:  1978 N=1912   1979 N=1810

          A: BELOW 50%       B:  50-64%        C:  65-84%         D: 85-100%
      ____1978____1979_____1978____1979______1978____1979____.__1978____1979_
NUMBER(%)  32.37    22.93     0.16     0.17      0.26     0.17     67.21    76.74
MEAN (%)    0.04     0.12    50.00    50.00     75.00    75.00    100.00   100.00

          TABLES CCMPARING 1978 AND 1979 MEAN SCCRES AND PROPORTIONS
   ___PROPORTION TEST___ #  ____________________F-TEST______________________
   HO: PRCPOR78=PROPOR79 #  _________SS________  ______DF______
   _T-CALC___DF____PROB_#__BETWEEN______WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
A:   6.431   3720   0.000 #      1.59     1867.97    1      1032     0.881   0.348
B:  -0.067   3720   0.946 # <<<<<<<<<<<<<< SSW IS EQUAL TO ZERO >>>>>>>>>>>>>>
C:   0.631   3720   0.529 # <<<<<<<<<<<<<< SSW IS EQUAL TO ZERO >>>>>>>>>>>>>>
D:  -6.463   3720   0.000 # <<<<<<<<<<<<<< SSW IS EQUAL TO ZERO >>>>>>>>>>>>>>


   ______COMPARING_THE_MEAN_SCORES_OF_PUPILS_WITHIN_ZONE_SUBGROUPS_______
                            __________________F-TEST TABLE_________________
GROUPS        YEARS      #  _________SS________  ______DF______
======_____1978_____1979__#__BETWEEN______WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
EARLY       65.17    75.21 # 61391.48 5037608.52    1       2438    29.711   0.000
LATE        72.47    80.61 # 19957.59 2147646.06    1       1204    11.188   0.001
MALE        57.65    70.25 # 76222.34 4337280.52    1       1920    33.742   0.000
FEMALE      78.06    84.11 # 16448.37 2744076.29    1       1798    10.777   0.001
NORTH       63.23    75.37 # 36176.10 2060911.89    1        981    17.220   0.000
SOUTH       69.07    77.53 # 48982.15 5291716.10    1       2737    25.335   0.000
PUBLIC      67.44    78.36 # 87714.50 5730721.20    1       2941    45.015   0.000
SEPARATE    67.70    71.67 #  306        23042.49   1        777     1.466   0.226
```

FIGURE 69

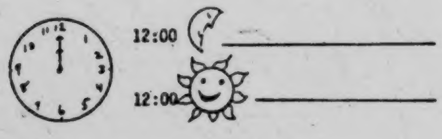
LEVEL C (Grade 3)

MEASUREMENT

OBJECTIVE 3 *Uses noon, midnight, a.m. and p.m*

TEST ITEMS

13. Put noon or midnight in the blanks.



14. Put a.m. or p.m. in the blanks.

9:00 ______ is time for school to start.	3:30 ______ is time for school to finish.
8:00 ______ is the time to go to bed.	7:00 ______ is the time to get up in the morning.

ANALYSIS

```
 _ZONE_ONE__PUPILS_IN_1978_AND_1979_ACHIEVING_WITHIN_EACH_CATAGORY_A-D_
     CRITERION CATEGORIES FOR    GRADE:3   STRAND:3   OBJECTIVE: 3
          TOTAL NUMBER OF PUPILS:  1978 N=1912   1979 N=1810

           A: BELOW 50%       B:  50-64%        C:  65-84%        D: 85-100%
       ____1978____1979_____1978____1979_____1978____1979_____1978____1979_
NUMBER(%)    7.90     9.01    13.96   15.80    10.20     9.06    67.94   66.13
MEAN (%)    16.06    13.34    52.95   52.58    75.00    75.00    98.61   98.72

            TABLES COMPARING 1978 AND 1979 MEAN SCORES AND PROPORTIONS
   ___PROPORTION TEST___ #  ___________________F-TEST_______________________
   HO: PROPOR78=PROPOR79 #  ________SS________  ______DF______
   _T-CALC____DF____PROB_#__BETWEEN_____WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
A:  -1.216  3720   0.224 #    578.24   76408.22     1        312    2.361  0.125
B:  -1.575  3720   0.116 #     18.98   14838.05     1        551    0.705  0.402
C:   1.175  3720   0.240 # <<<<<<<<<<<<<< SSW IS EQUAL TO ZERO >>>>>>>>>>>>>>
D:   1.172  3720   0.241 #      6.38   37249.66     1       2494    0.427  0.513


   ______COMPARING_THE_MEAN_SCORES_OF_PUPILS_WITHIN_ZONE_SUBGROUPS_______
                            ___________________F-TEST TABLE_________________
GROUPS         YEARS      #  ________SS________  ______DF______
======_____1978____1979__#__BETWEEN_____WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
EARLY        82.99   81.15 #   2067.88 1872708.70     1       2438    2.692  0.101
LATE         84.20   82.38 #    997.44  801867.02     1       1204    1.498  0.221
MALE         81.68   79.68 #   1917.37 1521663.21     1       1920    2.419  0.120
FEMALE       85.06   83.61 #    940.78 1199214.69     1       1798    1.411  0.235
NORTH        82.80   78.56 #   4407.91  744091.26     1        981    5.811  0.016
SOUTH        83.50   82.64 #    501.57 1983277.86     1       2737    0.692  0.406
PUBLIC       82.88   81.56 #   1288.42 2248615.06     1       2941    1.685  0.194
SEPARATE     84.90   81.70 #   1992.71  483406.04     1        777    3.203  0.074
```

FIGURE 70

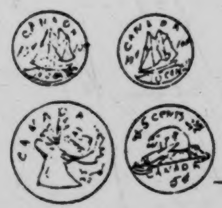
LEVEL C (Grade 3)

MEASUREMENT

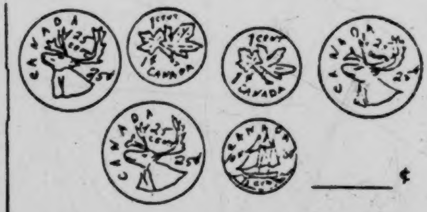
OBJECTIVE 4 *Counts collections of coins up to $1.00.*

TEST ITEMS

15. In the blanks, write how much monoy there is in each group of coins.



____¢



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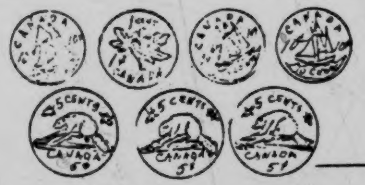

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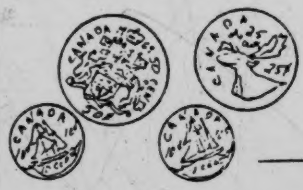

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ANALYSIS

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      _ZONE_ONE__PUPILS_IN_1978_AND_1979_ACHIEVING_WITHIN_EACH_CATAGCRY_A-D_
          CRITERION CATEGCRIES FOR     GRADE:3   STRAND:3   CBJECTIVE: 4
                TOTAL NUMBER OF PUPILS:  1978 N=1912    1979 N=1810

            A: BELOW 50X        B:  50-64X          C:  65-84X          D: 85-100X
        ____1978____1979_____1978____1979______1978____1979_____1978____1979_
NUMBER(X)  15.43    15.08     16.16    14.81      28.14    28.07     40.27    42.04
MEAN (X)   14.24    12.04     50.00    50.00      75.00    75.00    100.00   100.00

             TABLES CCMPARING 1978 AND 1979 MEAN SCORES AND PROPORTIONS
   ___PROPORTION TEST___ #  ___________________F-TEST______________________
   HO: PROPOR78=PROPOR79 #  _________SS_________  ______DF______
   _T-CALC____DF____PROB_#__BETWEEN______WITHIN__BETWEEN_WITHIN__F-RATIC__PROB
A:    0.293   3720   0.769 #    683.24    87646.16     1      566     4.412  0.036
B:    1.141   3720   0.254 # <<<<<<<<<<<<<< SSW IS EQUAL TO ZERO >>>>>>>>>>>>>>
C:    0.049   3720   0.961 # <<<<<<<<<<<<<< SSW IS ECUAL TO ZERO >>>>>>>>>>>>>>
D:   -1.098   3720   0.272 # <<<<<<<<<<<<<< SSW IS EQUAL TO ZERO >>>>>>>>>>>>>>


     _____CCMPARING_THE_MEAN_SCCRES_OF_PUPILS_WITHIN_ZONE_SUBGROUPS_______
                            ___________________F-TEST TABLE__________________
GROUPS        YEARS        #  _________SS_________  ______DF______
======_____1978____1979__#__BETWEEN______WITHIN__BETWEEN_WITHIN__F-RATIC__PROB
EARLY        71.27    71.98 #    310.09 2361554.60     1      2438    C.320  0.572
LATE         72.39    72.99 #    108.63 1094953.04     1      1204    0.119  0.730
MALE         73.33    74.50 #    657.63 1724989.24     1      1920    0.732  0.392
FEMALE       69.85    69.99 #      8.87 1801916.13     1      1798    0.009  0.925
NORTH        70.98    68.76 #   1203.03  971460.37     1       981    1.215  0.271
SOUTH        71.90    73.55 #   1854.88 2562206.71     1      2737    1.981  0.160
PUBLIC       71.68    72.22 #    211.96 2778122.75     1      2941    0.224  0.636
SEPARATE     71.53    72.67 #    249.22  763731.85     1       777    0.254  0.615
```

FIGURE 71

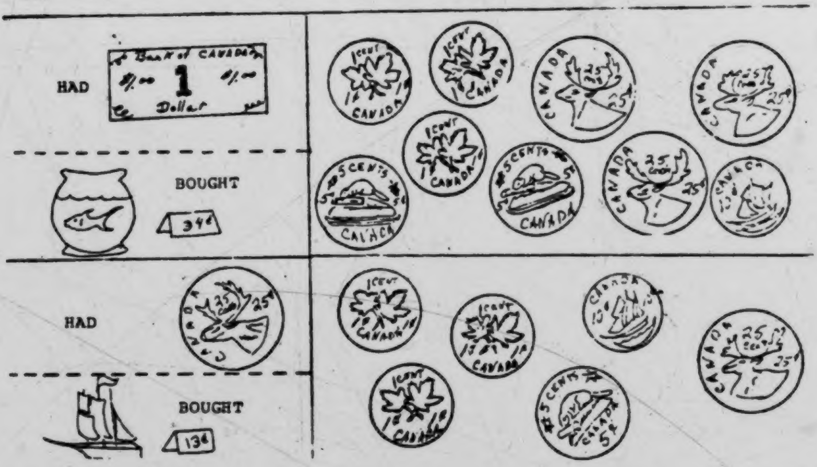
LEVEL C (Grade 3)

MEASUREMENT

OBJECTIVE 5 *Makes purchases and change up to $1.00.*

TEST ITEMS

16. Circle the coins you would get for change if you bought these:



ANALYSIS

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 _ZONE_ONE__PUPILS_IN_1978_AND_1979_ACHIEVING_WITHIN_EACH_CATAGCRY_A-D_
      CRITERION CATEGCRIES FOR     GRADE:3   STRAND:3   OEJECTIVE: 5
           TOTAL NUMBER OF PUPILS:  1978 N=1912    1S79 N=1810

           A: BELOW 50%      B:  50-64%        C:  65-84%        D: 85-100%
       ____1978____1979_____1978____1979_____1978____1979_____1978____1979_
NUMBER(%)  43.15    42.54     31.12    33.15     0.47     0.22     25.26   24.09
MEAN (%)    0.30     0.34     50.02    50.00    75.00    75.00     99.74  100.00

            TABLES COMPARING 1978 AND 1979 MEAN SCORES AND PROPORTIONS
   ___PROPORTION TEST___ #  ____________________F-TEST_____________________
   HO: PRCPOR78=PROPOR79 #  ________SS________  ______DF______
   _T-CALC____DF____PROB_#__BETWEEN_____WITHIN__BETWEEN_WITHIN__F-RATIC__PROB
A:   0.374   3720   0.708 #      0.57   13116.00    1     1593     0.069  0.792
B:  -1.326   3720   0.185 #      0.13     155.99    1     1193     1.008  0.316
C:   1.291   372C   0.197 #  <<<<<<<<<<<<<< SSW IS EQUAL TC ZERO >>>>>>>>>>>>>>
D:   0.830   3720   0.407 #     15.35    1530.15    1      917     9.198  0.003


      ______CCMPARING_THE_MEAN_SCORES_OF_PUPILS_WITHIN_ZONE_SUBGROUPS_______
                            ___________________F-TEST TABLE__________________
GROUPS          YEARS      #  ________SS________  ______DF______
======_____1978____1979__#__BETWEEN______WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
EARLY       42.05   41.73 #     61.42  3939671.93     1     2438    C.038   0.845
LATE        40.05   38.63 #    605.49  1864259.25     1     1204    0.391   0.532
MALE        40.92   42.13 #    697.56  3052204.37     1     1920    0.439   0.508
FEMALE      41.59   39.75 #   1530.78  2895413.67     1     1798    0.951   0.330
NORTH       40.65   34.48 #   9343.84  1570766.48     1      981    5.836   0.016
SOUTH       41.47   43.23 #   2136.56  4352793.27     1     2737    1.343   0.247
PUBLIC      42.03   40.87 #    980.53  4774834.64     1     2941    0.604   0.437
SEPARATE    38.34   41.37 #   1787.00  1171142.64     1      777    1.186   0.277
```

FIGURE 72

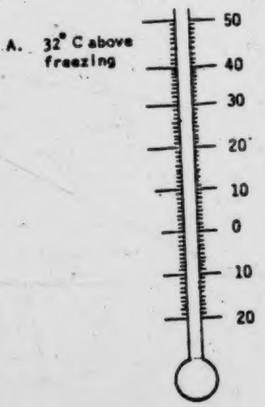
LEVEL C (Grade 3)

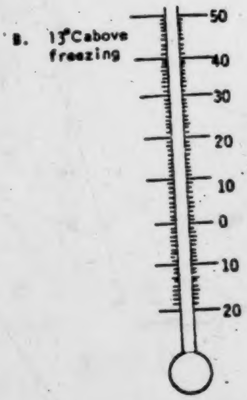
MEASUREMENT

OBJECTIVE 6 *Reads Celsius thermometer to one degree intervals.*

TEST ITEMS

11. Colour each thermometer to show the temperature.





ANALYSIS

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                    ZONE_ONE__PUPILS_IN_1978_AND_1979_ACHIEVING_WITHIN_EACH_CATAGCRY_A-D_
 _ZONE_ONE__PUPILS_IN_1978_AND_1979_ACHIEVING_WITHIN_EACH_CATAGCRY_A-D_
     CRITERION CATEGCRIES FOR    GRADE:3   STRAND:3   OEJECTIVE: 6
           TOTAL NUMBER OF PUPILS:  1978 N=1912   1979 N=1810
                                                                  D: 85-100%
                                                C:  65-84%       1978____1979_
                          B:  50-64%          1978____1979______59.78   62.32
        A: BELOW 50%    1978____1979______  0.10     0.17     100.00  100.00
     ____1978____1979____26.41    21.99    75.00    75.00
NUMBER(%)  13.70    15.52  50.00    50.00
MEAN (%)    0.29     0.18
                                    AND PROPORTIONS
          TABLES CCMPARING 1978 AND 1979 MEAN SCORES AND PROPORTIONS
                                                F-TEST______________________
   ___PROPORTION TEST___ #  ____________________        ______DF______
   HO: PRCPOR78=PROPOR79 #  ________SS________  ______DF______  F-RATIO__PROB
   _T-CALC____DF____PROB_#__BETWEEN_____WITHIN__BETWEEN_WITHIN    0.278  0.598
A:  -1.574   3720   0.116 #    1.59     3094.63     1       541
B:   3.146   3720   0.002 #  <<<<<<<<<<<<< SSW IS EQUAL TO ZERO >>>>>>>>>>>>>>
C:  -0.509   3720   0.611 #  <<<<<<<<<<<<< SSW IS EQUAL TO ZERO >>>>>>>>>>>>>>
D:  -1.588   3720   0.112 #  <<<<<<<<<<<<< SSW IS EQUAL TC ZERO >>>>>>>>>>>>>>

            COMPARING THE MEAN SCORES OF PUPILS WITHIN ZONE SUBGROUPS______
     ______COMPARING_THE_MEAN_SCORES_OF_PUPILS_WITHIN_ZONE_SUBGROUPS______
                                          F-TEST TABLE_________________
                              ____________________   ______DF______
GROUPS        YEARS       #  ________SS________  BETWEEN WITHIN__F-RATIO__PROB
======_____1978____1979___#__BETWEEN_____WITHIN                 0.245   0.621
EARLY      73.13   72.38  #    339.86 3387486.99    1     2438  0.905   0.342
LATE       73.43   75.39  #   1148.60 1528384.98    1     1204  0.145   0.703
MALE       73.84   73.20  #    193.94 2563778.81    1     1920  0.677   0.411
FEMALE     72.32   73.75  #    921.63 2446353.02    1     1798  1.390   0.239
NORTH      74.03   71.20  #   1965.88 1387143.98    1      981  1.155   0.283
SOUTH      72.76   74.26  #   1527.69 3620384.96    1     2737  0.138   0.710
PUBLIC     73.23   72.72  #    190.02 4044030.59    1     2941  2.130   0.145
SEPARATE   72.68   76.33  #   2640.63  963349.42    1      777
```

FIGURE 73

LEVEL C (Grade 3)

MEASUREMENT

OBJECTIVE 7 *Extends estimation and measurement to include the use of the standard units km, dm .*

TEST ITEMS

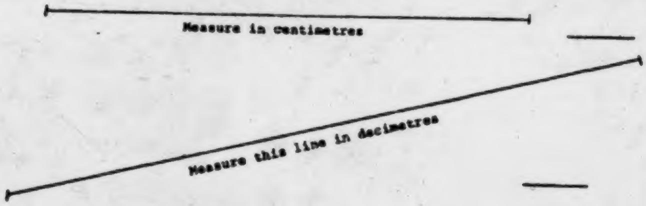
20. Estimate the width of this test paper in centimetres. Circle your estimate.

10 cm 20 cm 30 cm 40 cm

Estimate the length of this test paper in decimetres. Circle your estimate.

1 dm 3 dm 5 dm 6 dm

21. Use your rulers to measure the lines below. Show your answer on the blank.



ANALYSIS

```
_ZONE_ONE__PUPILS_IN_1978_AND_1979_ACHIEVING_WITHIN_EACH_CATAGCRY_A-D_
     CRITERION CATEGORIES FOR     GRADE:3   STRAND:3   OBJECTIVE: 7
          TOTAL NUMBER OF PUPILS:  1978 N=1912   1979 N=1810 .

           A: BELOW 50%       B:  50-64%        C:  65-84%        D: 85-100%
       ----1978----1979-----1978----1979-----1978----1979-----1978----1979_
NUMBER(%)  32.01    31.71    23.22   24.70    24.79   25.25    19.98   18.34
MEAN (%)   20.26    19.48    51.33   50.78    75.32   75.20    99.76   99.75

           TABLES COMPARING 1978 AND 1979 MEAN SCORES AND PROPORTIONS
   ___PROPORTION TEST___ #  ____________________F-TEST____________________
   HO: PRCPOR78=PROPOR79 #  ________SS________  ______DF______
   _T-CALC___DF___PRCB_#__BETWEEN_____WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
A:   0.193   3720   0.847 #   179.41  199621.51     1     1184    1.064  0.303
B:  -1.054   3720   0.292 #    67.28    6784.73     1      889    8.816  0.003
C:  -0.322   3720   0.747 #     3.12   10003.59     1      929    0.290  0.590
D:   1.267   3720   0.205 #     0.02    1415.42     1      712    0.011  0.917

   ______COMPARING_THE_MEAN_SCORES_OF_PUPILS_WITHIN_ZONE_SUBGROUPS______
                                 _________________F-TEST TABLE__________________
GROUPS        YEARS        #  ________SS________  ______DF______
======_____1978____1979__#__BETWEEN_____WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
EARLY        57.44    55.58 #   2095.59 2303800.10    1     2438    2.218  0.137
LATE         56.99    56.54 #     63.23 1115745.69    1     1204    0.068  0.794
MALE         57.35    56.61 #    263.47 1826264.30    1     1920    0.277  0.599
FEMALE       56.64    55.36 #    737.53 1669895.18    1     1758    0.794  0.373
NORTH        59.35    52.00 #  13250.98  945169.95    1      981   13.753  0.000
SOUTH        56.14    57.40 #   1076.08 2527954.18    1     2737    1.160  0.282
PUBLIC       57.79    54.42 #   8335.69 2781939.72    1     2941    8.812  0.003
SEPARATE     54.10    62.07 #  12328.40  693452.34    1      777   13.814  0.000
```

FIGURE 74

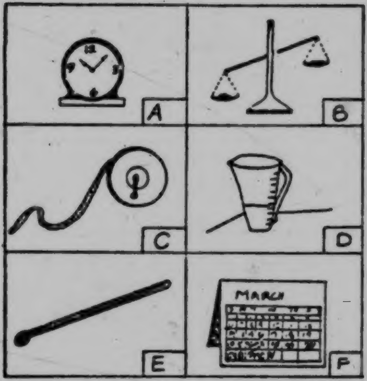
LEVEL C (Grade 3)

MEASUREMENT

OBJECTIVE 8 *Uses standard instruments, (metre stick, litre container, mass scales, calendar, Celsius thermometer).*

TEST ITEMS

18. Place the letter from the correct box that answers each question.



How heavy? ____
How long? ____
How warm? ____
What day? ____
How much water? ____

ANALYSIS

```
 _ZONE_ONE__PUPILS_IN_1978_AND_1979_ACHIEVING_WITHIN_EACH_CATAGORY_A-D_
     CRITERION CATEGORIES FOR    GRADE:3   STRAND:3   OBJECTIVE: 8
          TOTAL NUMBER OF PUPILS:  1978 N=1912   1979 N=1810

          A: BELOW 50%       B:  50-64%        C:  65-84%        D: 85-100%
      ____1978____1979_____1978____1979______1978____1979_____1978____1979_
NUMBER(%)  7.32     8.12      2.09     2.54      8.00     5.69     82.58   83.65
MEAN (%)   4.68     4.46     60.00    59.35     80.00    80.00     99.99  100.00

          TABLES COMPARING 1978 AND 1979 MEAN SCORES AND PROPORTIONS
   ___PROPORTION TEST___  #  ____________________F-TEST______________________
   HO: PROPOR78=PROPOR79  #  _________SS________  ______DF______
   _T-CALC___DF____PROB_#__BETWEEN_____WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
A:  -0.914  3720   0.361 #      3.56   36467.00    1       285    0.028  0.868
B:  -0.912  3720   0.362 #      9.10     280.43    1        84    2.726  0.102
C:   2.785  3720   0.006 # <<<<<<<<<<<<<< SSW IS EQUAL TO ZERO >>>>>>>>>>>>>>
D:  -0.865  3720   0.387 #      0.03      99.94    1      3051    0.959  0.328


   _____COMPARING_THE_MEAN_SCORES_OF_PUPILS_WITHIN_ZONE_SUBGROUPS______
                             ___________________F-TEST TABLE________________
GROUPS        YEARS      #   _________SS________  ______DF______
======______1978____1979_#__BETWEEN_____WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
EARLY        90.06   88.50 #   1474.08 1852655.38    1      2438    1.940  0.164
LATE         92.07   93.07 #    305.87  610578.13    1      1204    0.603  0.438
MALE         89.67   89.95 #     39.01 1370812.83    1      1920    0.055  0.815
FEMALE       91.56   90.19 #    835.22 1172458.65    1      1798    1.281  0.258
NORTH        90.43   89.27 #    326.69  707056.66    1       981    0.453  0.501
SOUTH        90.63   90.35 #     56.66 1837527.95    1      2737    0.084  0.772
PUBLIC       90.58   89.56 #    753.74 2066750.86    1      2941    1.073  0.301
SEPARATE     90.58   88.00 #    391.22  476488.30    1       777    0.638  0.425
```

FIGURE 75

LEVEL C (Grade 3)

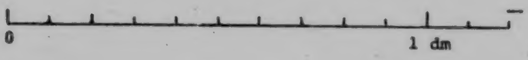
MEASUREMENT

OBJECTIVE 9 *Expresses linear measurement to the nearest tenth.*

TEST ITEMS

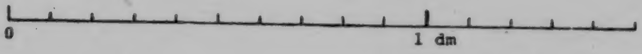
17. Write the answer in the box. Use decimals to show the length of the lines in decimetres.

a)



☐ dm

b)



☐ dm

ANALYSIS

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 _ZCNE_ONE__PUPILS_IN_1978_AND_1979_ACHIEVING_WITHIN_EACH_CATAGCRY_A-D_
     CRITERION CATEGCRIES FOR     GRADE:3   STRAND:3   CEJECTIVE: 9
          TOTAL NUMBER OF PUPILS:  1978 N=1912   1979 N=1810

          A: BELOW 50%       B:  50-64%        C:  65-84%        D: 85-100%
      ----1978----1979-----1978----1979-----1978----1979-----1978----1979_
NUMBER(%)  59.10   54.14     5.39    5.64     0.21    0.06    35.30   40.17
MEAN (%)    0.0     0.10    50.00   50.00    75.00   75.00   100.00  100.00

          TABLES COMPARING 1978 AND 1979 MEAN SCORES AND PROPORTIONS
   ___PROPORTION TEST___ #  ____________________F-TEST______________________
   HO: PRCPOR78=PROPOR79 #  ________SS________  ______DF______
   _T=CALC____DF____PROB_#__BETWEEN_____WITHIN__BETWEEN_WITHIN__F-RATIC__PRCB
A:   3.050   3720   0.002 #     5.46    2489.80     1     2108    4.627  0.032
B:  -0.332   3720   0.740 # <<<<<<<<<<<<< SSW IS EQUAL TC ZERO >>>>>>>>>>>>>>
C:   1.282   372C   0.200 # <<<<<<<<<<<<< SSW IS EQUAL TO ZERO >>>>>>>>>>>>>>
D:  -3.060   3720   0.002 # <<<<<<<<<<<<< SSW IS EQUAL TC ZERO >>>>>>>>>>>>>>


   ------COMPARING_THE_MEAN_SCORES_OF_PUPILS_WITHIN_ZONE_SUBGROUPS_______
                            __________________F-TEST TABLE_________________
GROUPS        YEARS      #  ________SS________  ______DF______
======_____1978____1979__#__BETWEEN_____WITHIN__BETWEEN_WITHIN__F-RATIC__PRCB
EARLY       38.52   42.52 #  9760.15 5492891.24    1      2438    4.332  0.038
LATE        38.42   42.12 #  4120.88 2757923.07    1      1204    1.799  0.180
MALE        36.67   43.24 # 20745.05 4305164.16    1      1920    9.252  0.002
FEMALE      39.75   42.91 #  4489.36 4110882.52    1      1798    1.964  0.161
NORTH       43.75   34.58 # 20602.53 2178212.33    1       981    9.279  0.002
SOUTH       36.09   46.03 # 67763.21 6174842.21    1      2737   30.036  0.000
PUBLIC      39.97   40.92 #   668.06 6703825.23    1      2941    0.293  0.588
SEPARATE    31.37   51.33 # 77477.85 1661045.90    1       777   36.242  0.000
```

FIGURE 76

without errors.

Money measurement caused many students difficulty. Seventy percent of the pupils counted coin collections up to $1.00 with 75 or 100 percent accuracy (4 items). Nearly the same proportion of students could manage only 50 percent or less when coin representations were used for making purchases and change up to $1.00.

The metric system objectives (Figures 73,74, and 75) showed mixed performance figures. About sixty percent of the pupils in 1978 and 1979 could read the Celsius thermometer to one degree intervals with 100 percent accuracy. Another twenty-two percent could correctly record temperatures for one of the two thermometers.

Under twenty percent of the pupils in 1979 could estimate and measure using centimetres and decimetres with 100 percent accuracy. Over fifty percent of the grade three pupils correctly estimated and measured one or two of the four items correctly.

One out of every two pupils could not express linear measures to tenths. The proportion who could write the decimal form to the 85-100 percent level increased significantly in 1979 but only to forty percent of the pupils.

GEOMETRY (Four objectives; Figures 77 to 80)

Hypothesis 1

One objective had performances where eighty percent of

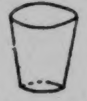
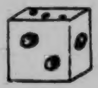
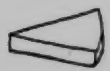
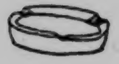
LEVEL C (Grade 3)

GEOMETRY

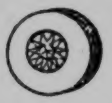
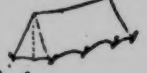
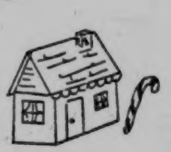
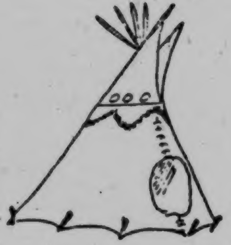
OBJECTIVE 1 *Classifies and identifies 2-dimensional figures and 3-dimensional objects.*

TEST ITEMS

1. Put an X on the picture of the item that is like a cube.

2. Put an X on the picture of the item that is like a cone.

ANALYSIS

```
 _ZONE_ONE__PUPILS_IN_1978_AND_1979_ACHIEVING_WITHIN_EACH_CATAGCRY_A-D_
     CRITERION CATEGCRIES FOR     GRADE:3   STRAND:4   CEJECTIVE: 1
           TOTAL NUMBER OF PUPILS:  1978 N=1912    1979 N=1810

            A: BELOW 50%        B:  50-64%         C:  65-84% -       D: 85-100%
         ____1978____1979_____1978____1979_____1978____1979_____1978____1979_
NUMBER(%)    3.61     3.43     8.84     9.34      0.0      0.11    87.55    87.13
MEAN (%)     0.56     2.42    50.00    50.15   ******     75.00   100.00   100.00

           TABLES CCMPARING 1978 AND 1979 MEAN SCCRES AND PROPORTIONS
   ___PROPORTION TEST___ #  _____________________F-TEST_______________________
   HO: PRCPOR78=PROPOR79 #  ________SS________  ______DF______
   _T-CALC____DF____PROB_#__BETWEEN_____WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
A:    0.303   3720   0.762 #   114.92     4460.47     1      129     3.323  0.071
B:   -0.529   3720   0.597 #     1.85      308.20     1      336     2.012  0.157
C:   -1.454   3720   0.146 #  <<<<<<<< TOO FEW PUPILS FOR CALCULATICNS >>>>>>>>
D:    0.390   3720   0.697 #  <<<<<<<<<<<<<< SSW IS EQUAL TO ZERO >>>>>>>>>>>>>>

   -------COMPARING_THE_MEAN_SCORES_CF_PUPILS_WITHIN_ZONE_SUBGROUPS______
                                  ___________________F-TEST TABLE__________________
GROUPS        YEARS        #   ________SS________  ______DF______
======_____1978____1979__#__BETWEEN______WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
EARLY        91.35    91.72 #     84.41 1298478.85     1      2438     0.158  0.691
LATE         93.25    92.74 #     76.38  525423.85     1      1204     0.172  0.679
MALE         91.50    91.42 #      3.57 1037189.22     1      1920     0.007  0.935
FEMALE       92.52    92.57 #      1.22  843933.16     1      1798     0.003  0.959
NORTH        91.42    91.01 #     42.83  518655.03     1       981     0.081  0.776
SOUTH        92.20    92.31 #      8.44 1362740.17     1      2737     0.017  0.896
PUBLIC       92.36    91.71 #    310.77 1479798.92     1      2941     0.618  0.432
SEPARATE     90.63    93.00 #   1096.99  400960.94     1       777     2.126  0.145
```

FIGURE 77

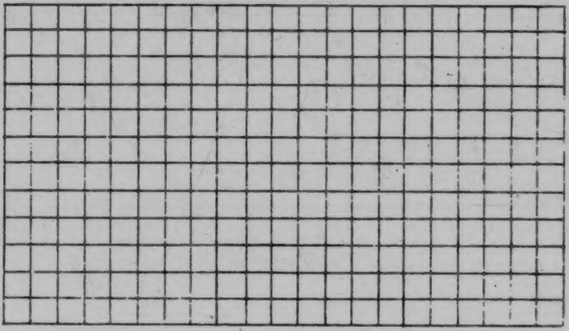
LEVEL C (Grade 3)

GEOMETRY

OBJECTIVE 2 *Constructs 2-dimensional figures using straws, pipecleaners, wires, geoboard, etc.*

TEST ITEMS

19. On the grid paper below draw a square, a rectangle, and a triangle.



ANALYSIS

```
 _ZONE_ONE__PUPILS_IN_1978_AND_1979_ACHIEVING_WITHIN_EACH_CATAGCRY_A-D_
     CRITERICN CATEGORIES FOR    GRADE:3   STRAND:4   OEJECTIVE: 2
          TOTAL NUMEER OF PUPILS:  1978 N=1912   1979 N=1810

          A: BELOW 50%       B:  50-64%         C:  65-84%         D: 85-100%
      ____1978____1979_____1978____1979_____1978____1979_____1978____1979_
NUMBER(%)  11.56    11.93     0.16     0.39     20.24    17.73     68.04    69.94
MEAN (%)    7.01     6.79    50.00    50.00     66.71    67.00    100.00   100.00

           TABLES CCMPARING 1978 AND 1979 MEAN SCORES AND PROPORTIONS
   ___PROPORTION TEST___ #  ____________________F-TEST_______________________
   HC: PRCPOR78=PROPOR79 #  ________SS________ ______DF______
   _T-CALC____DF____PROB_#__BETWEEN_____WITHIN__BETWEEN_WITHIN__F-RATIC__PROB
A:   -0.355  3720   0.722 #     5.45   77503.44     1       435     0.031  0.661
B:   -1.354  3720   0.176 # <<<<<<<<<<<<<< SSW IS EGUAL TC ZERO >>>>>>>>>>>>>>
C:    1.947  3720   0.052 #    15.21    1837.72     1       706     5.843  0.016
D:   -1.253  3720   0.211 # <<<<<<<<<<<<<< SSW IS EGUAL TO ZERO >>>>>>>>>>>>>>

   _____COMPARING_THE_MEAN_SCORES_OF_PUPILS_WITHIN_ZONE_SUBGROUPS______
                            ___________________F-TEST TABLE__________________
GROUPS         YEARS      # ________SS________ ______DF______
======_____1978____1979__#__BETWEEN_____WITHIN__BETWEEN_WITHIN__F-RATIC__PROB
EARLY       82.54   81.99 #   182.16 2433749.42    1      2438     C.182  0.669
LATE        83.12   84.87 #   928.19  993723.32    1      1204     1.125  0.289
MALE        80.62   81.67 #   526.60 2000288.09    1      1920     0.505  0.477
FEMALE      84.38   84.06 #    45.37 1537198.11    1      1798     0.053  0.818
NORTH       80.20   75.79 #  4778.54 1137563.64    1       981     4.121  0.043
SOUTH       83.26   85.28 #  2793.03 2374477.92    1      2737     3.219  0.073
PUBLIC      83.58   81.52 #  3105.16 2899366.71    1      2941     3.150  0.076
SEPARATE    78.18   87.84 # 18177.64  626278.22    1       777    22.552  C.000
```

FIGURE 78

LEVEL C (Grade 3)

GEOMETRY

OBJECTIVE 3 *Constructs 3-dimensional objects with Plasticine or modeling clay.*

TEST ITEMS

Give students the plasticine and ask them to make something that looks like...

(a) a cube (b) a sphere

22. Constructs 3 dimensional figure.

	Yes	No
(1) cube	___	___
(2) sphere	___	___

ANALYSIS

```
 _ZONE_ONE__PUPILS_IN_1978_AND_1979_ACHIEVING_WITHIN_EACH_CATAGORY_A-D_
    CRITERION CATEGORIES FOR     GRADE:3   STRAND:4   OBJECTIVE: 3
           TOTAL NUMBER OF PUPILS:  1978 N=1912    1979 N=1810

           A: BELOW 50%      B:  50-64%          C:  65-84%        D: 85-100%
       ____1978____1979_____1978____1979_____1978____1979_____1978____1979_
NUMBER(%)  11.19    14.64     36.04    30.77      0.0      0.17     52.77   54.42
MEAN (%)    0.40     3.06     50.00    50.00    ******    80.00    100.00  100.00

            TABLES COMPARING 1978 AND 1979 MEAN SCORES AND PROPORTIONS
   ___PROPORTION TEST___ #  ____________________F-TEST_____________________
   HO: PROPOR78=PROPOR79 #  _________SS________  ______DF______
   _T-CALC____DF____PROB_#__BETWEEN_____WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
A:  -3.140   3720   0.002 #   837.32   20215.39    1       477   19.757  0.000
B:   3.400   3720   0.001 #  <<<<<<<<<<<<<< SSW IS EQUAL TO ZERO >>>>>>>>>>>>>>
C:  -1.791   3720   0.075 #  <<<<<<<<< TOO FEW PUPILS FOR CALCULATIONS >>>>>>>>
D:  -1.008   3720   0.314 #  <<<<<<<<<<<<<< SSW IS EQUAL TO ZERO >>>>>>>>>>>>>>

      ______COMPARING_THE_MEAN_SCORES_OF_PUPILS_WITHIN_ZONE_SUBGROUPS_______
                            ___________________F-TEST TABLE_________________
GROUPS        YEARS      #  _________SS_________  ______DF______
======______1978____1979__#__BETWEEN______WITHIN__BETWEEN WITHIN__F-RATIO__PROB
EARLY        71.19   69.31 #   2139.34 3004059.84     1      2438    1.736  0.188
LATE         72.15   71.30 #    219.14 1380424.14     1      1204    0.191  0.662
MALE         71.71   71.37 #     55.08 2301265.01     1      1920    0.046  0.830
FEMALE       69.89   69.34 #    137.10 2231506.01     1      1758    0.110  0.740
NORTH        76.11   70.44 #   7895.89 1144069.26     1       981    6.770  0.009
SOUTH        68.88   70.37 #   1511.61 3372449.29     1      2737    1.227  0.268
PUBLIC       72.46   69.72 #   5516.80 3532682.90     1      2941    4.593  0.032
SEPARATE     64.78   72.95 #  12979.55  981648.88     1       777   10.274  0.001
```

FIGURE 79

LEVEL C (Grade 3)

GEOMETRY

OBJECTIVE 4 *Recognizes corresponding parts in polygons.*

TEST ITEMS

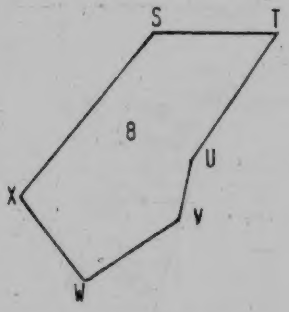
7. Fill in the blanks with the correct letters.

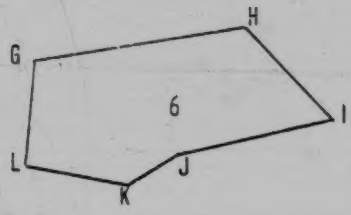
1. Which side from Figure 6 would fit side ST of Figure 8?

____

2. Which side from Figure 6 would fit side WV from Figure 8?

____





ANALYSIS

```
   _ZONE_ONE__PUPILS_IN_1978_AND_1979_ACHIEVING_WITHIN_EACH_CATAGCRY_A-D_
      CRITERION CATEGCRIES FOP     GRADE:3   STRAND:4   OEJECTIVE: 4
           TOTAL NUMBER OF PUPILS:  1978 N=1912    1979 N=1810

          A: BELOW 50%       B:  50-64%         C:  65-84%         D: 85-100%
      ____1978____1979_____1978____1979_____1978____1979_____1978____1979_
NUMBER(%)  36.82    36.57     28.97    27.62     0.0      0.33     34.21    35.47
MEAN (%)   0.0      0.04      50.00    50.00    ******   75.00    100.00   100.00

            TABLES CCMPARING 1978 AND 1979 MEAN SCORES AND PROPCRTIONS
   ___PROPORTION TEST___ #  ___________________F-TEST_____________________
   HC: PRCPOR78=PROPOR79 #  ________SS________  ______DF______
   _T-CALC____DF_____PROB_#__BETWEEN_____WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
A:    0.155   3720    0.877 #     0.49      624.06     1     1364     1.063   0.303
B:    0.914   3720    0.361 #  <<<<<<<<<<<<<< SSW IS EQUAL TC ZERO >>>>>>>>>>>>>>
C:   -2.520   3720    0.012 #  <<<<<<<< TOC FEW PUPILS FOR CALCULATICNS >>>>>>>>
D:   -0.809   3720.   0.418 #  <<<<<<<<<<<<<< SSW IS EQUAL TC ZERC >>>>>>>>>>>>>>


   ______COMPARING_THE_MEAN_SCORES_OF_PUPILS_WITHIN_ZONE_SUBGROUPS_______
                            __________________F-TEST TABLE________________
GROUPS        YEARS       #  ________SS________  ______DF______
======_____1978____1979__#__BETWEEN_____WITHIN__BETWEEN_WITHIN__F-RATIC__PRCB
EARLY        49.05    49.38 #    65.95 4356540.35    1      2438     0.037   0.848
LATE         48.47    48.24 #    15.63 2157375.02    1      1204     0.009   0.926
MALE         48.74    49.20 #   100.66 3446568.19    1      1920     0.056   0.813
FEMALE       48.64    49.91 #   725.74 3208423.91    1      1798     0.407   0.524
NORTH        56.49    46.20 # 25972.03 1812129.45    1       981    14.060   0.000
SOUTH        45.81    50.71 # 16420.71 4791063.31    1      2737     9.381   0.002
PUBLIC       49.20    49.06 #    15.46 5279025.06    1      2941     0.009   0.926
SEPARATE     46.78    51.40 #  4147.15 1370706.83    1       777     2.351   0.126
```

FIGURE 80

the Zone One pupils in 1978 and 1979 were at the 85-100 percent category.

Hypothesis 2

None of the objectives had significant increases in the proportion of pupils achieving to the 85-100 percent level in 1979 over 1978.

Findings

Pupils had no difficulty classifying and identifying 2-dimensional figures and 3-dimensional objects. About eighty-seven percent of the pupils were in category D (85-100 percent) for both 1978 and 1979.

About seven in ten pupils could construct the square, rectangle and triangle with 100 percent accuracy. The construction of the 3-dimensional cube and sphere items involved the actual use of plasticine. Slightly over fifty percent of the grade three pupils could successfully construct both the cube and the sphere. About one-third of the pupils could make only one or the other.

Only about one-third of the pupils could recognize corresponding parts in polygons to the 100 percent level. A slightly larger group scored zero on this objective. The mean scores of most of the sub-groups were at the 50 percent level.

GRAPHING (Four objectves; Figures 81 to 84)

Hypothesis 1

None of the objectives had performances where eighty percent of the Zone One pupils in 1978 and 1979 were at the 85-100 achievement level.

Hypothesis 2

Three objectives had significant increases in the proportion of pupils achieving at the 85-100 percent level in 1979 over 1978.

Findings

Almost sixty percent of the pupils in 1979 could identify the axes lines to the 100 percent level. That represented a twelve percent increase in the 100 percent group from 1978. All Zone One sub-groups had significant mean score increases for 1979, still, from one-half in 1978 to one-third of the pupils in 1979 could not identify the axes.

Significantly more pupils in 1979 could construct simple bar, line and pictographs than in 1978. Still only thirty-six percent could do so. Although all sub-groups mean scores increased, about forty percent of the Zone One pupils achieved at or below the 64 percent level.

Slightly better than 7 in 10 pupils could accurately locate the position of objects on a grid using co-ordinates. All sub-group means were over the 80 percent level. Three quarters of the pupils could plot points on a grid when given two coordinates in at lease three out of the four examples.

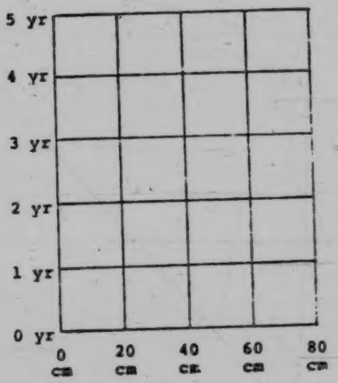
LEVEL C (Grade 3)

GRAPHING

OBJECTIVE 1 *Identifies the axes.*

TEST ITEMS

6. On the grid at the right, trace over the lines that are the axes. Use a red crayon.



ANALYSIS

```
 _ZONE_ONE__PUPILS_IN_1978_AND_1979_ACHIEVING_WITHIN_EACH_CATAGORY_A-D_
     CRITERION CATEGORIES FOR     GRADE:3   STRAND:5   OBJECTIVE: 1
          TOTAL NUMBER OF PUPILS:  1978 N=1912   1979 N=1810

                                                                   D: 85-100%
          A: BELOW 50%        B:  50-64X          C:  65-84%
                                                                 1978____1979_
      ____1978____1979_____1978____1979_____1978____1979_____1978____1979_
NUMBER(X)  50.31    37.24     3.24     3.87     0.0      0.0     46.44   58.50
MEAN (X)    0.0      0.0     50.00    50.00   ******   ******   100.00  100.00

            TABLES COMPARING 1978 AND 1979 MEAN SCORES AND PROPORTIONS
  ___PROPORTION TEST___ #  ____________________F-TEST______________________
  HO: PROPOR78=PROPOR79 #  _________SS________  ______DF______
  _T-CALC____DF____PROB_#__BETWEEN______WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
A:    8.034   3720   0.000 #  <<<<<<<<<<<<<< SSW IS EQUAL TO ZERO >>>>>>>>>>>>>>
B:   -1.030   3720   0.303 #  <<<<<<<<<<<<<< SSW IS EQUAL TO ZERO >>>>>>>>>>>>>>
C:    0.0     3720   1.000 #  <<<<<<<<< TOO FEW PUPILS FOR CALCULATIONS >>>>>>>>
D:   -7.603   3720   0.000 #  <<<<<<<<<<<<<< SSW IS EQUAL TO ZERO >>>>>>>>>>>>>>


      ______COMPARING_THE_MEAN_SCORES_OF_PUPILS_WITHIN_ZONE_SUBGROUPS_______
                                ___________________F-TEST TABLE__________________
GROUPS          YEARS        #  _________SS________  ______DF______
======______1978_____1979__#__BETWEEN______WITHIN__BETWEEN WITHIN__F-RATIO__PROB
EARLY        48.46    60.49 #  88075.50 5745521.83     1      2438   37.373   0.000
LATE         47.27    60.19 #  50289.82 2857232.98     1      1204   21.191   0.000
MALE         48.38    58.64 #  50471.02 4575383.56     1      1920   21.179   0.000
FEMALE       47.72    63.15 # 107109.65 4170777.85     1      1798   46.174   0.000
NORTH        53.10    59.96 #  11524.05 2291237.90     1       981    4.934   0.027
SOUTH        46.20    61.13 # 152543.38 6445957.90     1      2737   64.771   0.000
PUBLIC       50.96    60.56 #  67707.88 6958659.78     1      2941   28.616   0.000
SEPARATE     37.25    61.87 # 117827.41 1736543.58     1       777   52.721   0.000
```

FIGURE 81

LEVEL C (Grade 3)

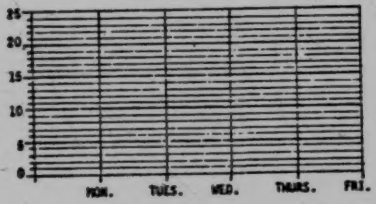
GRAPHING

OBJECTIVE 2 *Collects data and constructs simple bar, line and pictographs.*

TEST ITEMS

8. Read the story and draw the graph.

<u>Story</u>: Every day last week, Jill did an adding quiz. Here's how she scored. Draw a bar graph to show this information.

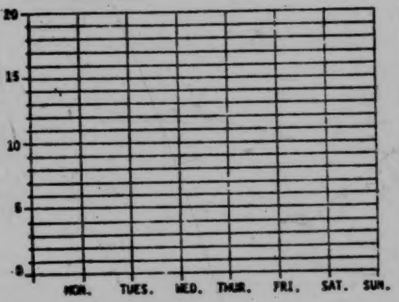


Mon. - 20 right
Tues. - 15 right
Wed. - 10 right
Thurs. - 16 right
Fri. - 20 right

9. Read the story and draw the graph.

<u>Story</u>: The Easter bunny left 5 eggs in Jane's basket, 2 eggs in Bill's basket, 3 eggs in Tom's basket, and no eggs in Jill's basket. Draw a picturegraph that would show the number of eggs each child got from the bunny.

10. Make a line graph showing the temperatures for the week.



Mon. 3° C
Tues. 7° C
Wed. 1° C
Thurs. 6° C
Fri. 8° C
Sat. 14° C
Sun. 12° C

ANALYSIS

```
_ZONE_ONE__PUPILS_IN_1978_AND_1979_ACHIEVING_WITHIN_EACH_CATAGORY_A-D_
    CRITERION CATEGORIES FOR     GRADE:3   STRAND:5    OBJECTIVE: 2
          TOTAL NUMBER OF PUPILS:  1978 N=1912    1979 N=1810

          A: BELOW 50%        B:  50-64%          C:  65-84%        D: 85-100%
      ____1978____1979_____1978____1979_____1978____1979_____1978____1979_
NUMBER(%)  37.24    28.45     10.77    10.83     25.05    24.14     26.94    36.57
MEAN (%)   20.27    21.38     55.10    55.95     70.96    70.71     98.16    97.46

          TABLES COMPARING 1978 AND 1979 MEAN SCORES AND PROPORTIONS
   ___PROPORTION TEST___ #  ____________________F-TEST_______________________
   HO: PROPOR78=PROPOR79 #  _________SS_________  ______DF______
   _T-CALC____DF____PROB_#__BETWEEN_____WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
A:   5.699   3720   0.000 #    364.15  293287.15     1       1225     1.521  0.218
B:  -0.054   3720   0.957 #     73.47    6175.84     1        400     4.759  0.030
C:   0.643   3720   0.520 #     14.79   41860.13     1        914     0.323  0.570
D:  -6.321   3720   0.000 #    141.18   15911.64     1       1175    10.425  0.001


     ______COMPARING_THE_MEAN_SCORES_OF_PUPILS_WITHIN_ZONE_SUBGROUPS_______
                               ___________________F-TEST TABLE________________
GROUPS          YEARS        #  _________SS_________  ______DF______
======______1978____1979__#__BETWEEN_____WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
EARLY        58.61     64.72 #  22742.61 2613653.08     1       2438    21.214  0,000
LATE         56.36     64.03 #  17686.73 1295601.00     1       1204    16.436  0.000
MALE         56.48     62.98 #  20291.07 2132012.66     1       1920    18.273  0.000
FEMALE       59.01     66.85 #  27613.34 1849131.11     1       1798    26.850  0.000
NORTH        63.05     57.71 #   6991.12  990217.82     1        981     6.926  0.009
SOUTH        55.72     67.34 #  92396.67 2948358.06     1       2737    85.773  0.000
PUBLIC       58.00     64.97 #  35769.82 3267858.21     1       2941    38.192  0.000
SEPARATE     56.60     64.42 #  11897.68  722384.17     1        777    12.797  0.000
```

FIGURE 82

LEVEL C (Grade 3)

GRAPHING

OBJECTIVE 3 *Locates position of an object on a grid.*

TEST ITEMS

4. Study the grid. Give the co-ordinates.

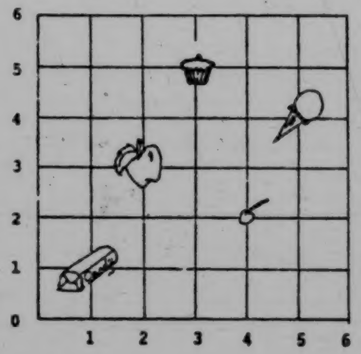
cupcake 3,5

apple

ice cream cone

candy

cherry



ANALYSIS

```
_ZONE_ONE__PUPILS_IN_1978_AND_1979_ACHIEVING_WITHIN_EACH_CATAGORY_A-D_
     CRITERION CATEGORIES FOR     GRADE:3   STRAND:9   OBJECTIVE: 3
          TOTAL NUMBER OF PUPILS:  1978 N=1912    1979 N=1810

          A: BELOW 50%       B:  50-64%        C:  65-84%        D: 85-100%
      ____1978____1979_____1978____1979_____1978____1979_____1978____1979_
NUMBER(%)  19.77   16.08     7.27    8.29     1.36    2.21    71.60   73.43
MEAN (%)   19.37   19.04    59.78   59.80    78.46   80.00    99.99   99.99

           TABLES COMPARING 1978 AND 1979 MEAN SCORES AND PROPORTIONS
   ___PROPORTION TEST___ #  ____________________F-TEST______________________
   HC: PRCPOR78=PROPOR79 #  _________SS_________  ______DF______
   _T-CALC____DF____PROB_#__BETWEEN______WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
A:    2.932  3720   0.003 #     17.61  163978.20      1       667    0.072  0.789
B:   -1.159  3720   0.247 #      0.02     587.53      1       287    0.009  0.925
C:   -1.964  3720   0.050 #     37.30     338.46      1        64    7.052  0.010
D:   -1.246  3720   0.213 #      0.00     199.85      1      2696    0.000  0.983


    _____COMPARING_THE_MEAN_SCORES_OF_PUPILS_WITHIN_ZONE_SUBGROUPS_______
                            ____________________F-TEST TABLE__________________
GROUPS        YEARS      #  _________SS_________  ______DF______
======_____1978____1979__#__BETWEEN______WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
EARLY       80.39   82.59 #   2961.18 2581631.90      1      2438    2.796  0.095
LATE        82.27   84.61 #   1648.24 1126613.12      1      1204    1.761  0.185
MALE        79.36   83.02 #   6400.49 2035126.88      1      1920    6.038  0.014
FEMALE      82.42   83.41 #    437.95 1773224.05      1      1798    0.444  0.505
NORTH       82.34   80.88 #    527.57 1002402.64      1       981    0.516  0.473
SOUTH       80.28   84.01 #   9543.90 2805458.80      1      2737    9.311  0.002
PUBLIC      81.43   83.74 #   3922.94 2976510.70      1      2941    3.876  0.049
SEPARATE    78.61   81.15 #   1247.61  831830.70      1       777    1.165  0.281
```

FIGURE 83

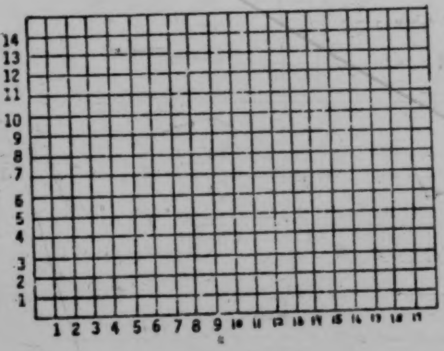
LEVEL C (Grade 3)

GRAPHING

OBJECTIVE 4 *Plots points on a grid when given the two co-ordinates.*

TEST ITEMS

5. Do these questions on the grid below:
   1. Draw a red dot on (9, 13).
   2. Draw a blue dot on (5, 2).
   3. Draw a black dot on (18, 4).
   4. Draw a green dot on (13, 9).



ANALYSIS

```
 _ZONE_ONE__PUPILS_IN_1978_AND_1979_ACHIEVING_WITHIN_EACH_CATAGORY_A-D_
     CRITERION CATEGORIES FOR     GRADE:3    STRAND:5    OBJECTIVE: 4
          TOTAL NUMBER OF PUPILS:  1978 N=1912    1979 N=1810

          A: BELOW 50%       B:  50-64%        C:  65-84%         D: 85-100%
                                                                1978____1979_
        ____1978____1979_____1978____1979_____1978____1979_____55.23    63.20
NUMBER(%)  22.96    17.68     6.38     6.35    15.43    12.76   100.00   100.00
MEAN (%)    6.95     7.34    50.00    50.00    75.00    75.00

            TABLES COMPARING 1978 AND 1979 MEAN SCORES AND PROPORTIONS
    ___PROPORTION TEST___ #  _____________________F-TEST_______________________
    HO: PROPOR78=PROPOR79 #  _________SS_________  ______DF______
    _T-CALC____DF____PROB_#__BETWEEN_____WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
A:    3.996   3720   0.000 #     29.05   96551.98     1       757    0.228  0.633
B:    0.034   3720   0.973 #  <<<<<<<<<<<<<< SSW IS EQUAL TO ZERO >>>>>>>>>>>>>>
C:    2.334   3720   0.020 #  <<<<<<<<<<<<<< SSW IS EQUAL TO ZERO >>>>>>>>>>>>>>
D:   -4.946   3720   0.000 #  <<<<<<<<<<<<<< SSW IS EQUAL TO ZERO >>>>>>>>>>>>>>


      ______COMPARING_THE_MEAN_SCORES_OF_PUPILS_WITHIN_ZONE_SUBGROUPS______
                             ____________________F-TEST TABLE__________________
GROUPS          YEARS        #  _________SS_________  ______DF______
======______1978_____1979__#__BETWEEN_____WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
                                                         1      2438     8.841  0.003
EARLY          71.17    75.66 #  12271.97 3384047.45     1      1204    12.228  0.001
LATE           72.63    79.97 #  16214.71 1596476.53     1      1920    18.144  0.000
MALE           69.80    77.09 #  25542.56 2702879.66     1      1798     5.206  0.023
FEMALE         73.51    77.42 #   6881.15 2376556.35     1       981     0.767  0.381
NORTH          76.21    78.16 #    929.48 1188334.28     1      2737    24.039  0.000
SOUTH          69.88    76.94 #  34095.79 3882095.79     1      2941    14.064  0.000
PUBLIC         73.16    78.19 #  18591.40 3887807.68     1       777     8.129  0.005
SEPARATE       68.72    73.67 #  12288.06 1174825.17     1
```

FIGURE 84

A. DISCUSSION OF THE GRADE THREE RESULTS

The combined achievement means for grade three pupils, given by objective and strand in Table 11, are similar for 1978 and 1979. The achievement means for individual objectives vary greatly with each strand showing both high and low performances.

Discussion specific to the individual strands will follow.

Number

Achievement within the number strand was very similar for 1978 and 1979, however the 15 percent drop from grade two for both years is rather dramatic. One explanation may be that the difficulties that emerged at the grade one and two levels on place value related skills appear to be compounding. The introduction of decimals to tenths could complicate the achievement picture although most pupils did reasonably well at reading and writing such numerals (Figure 57).

The success that many grade three pupils appear to have with identifying, writing and comparing fractions is encouraging. The content in the common fraction objective (Figure 58) represents a cutback from previous elementary mathematics programs and seems to be more in line with what the majority of children can handle.

This also holds for the 'order' and 'betweeness' concepts in conjunction with the inequalities (<,>) and the equals (=) symbols. This terminology was also introduced

TABLE 11
PERCENTAGE MEANS FOR GRADE THREE STUDENTS IN ZONE ONE FOR 1978 AND 1979

ZONE ONE GRADE THREE JUNE/78

NUMBER		OPERATIONS & PROPERTIES		MEASUREMENT		GEOMETRY		GRAPHING	
1	86.6%	1	70.8%	1	83.9%	1	92.0%	1	48.1%
2	69.7%	2	74.0%	2	47.5%	2	82.4%	2	57.7%
3	73.4%	3	84.4%	3	83.3%	3	70.8%	3	80,8%
4	45.4%	4	69.3%	4	71.7%	4	48.7%	4	71.6%
5	75.6%	5	78.2%	5	41.2%				
6	66.9%	6	72.0%	6	73.1%				
7	73.5%	7	68.2%	7	57.0%				
		8	82.9%	8	90.6%				
		9	56.0%	9	38.2%				
AVG	70.1%		72.9%		67.4%		74.5%		64.5%

ZONE ONE GRADE THREE JUNE/79

NUMBER		OPERATIONS & PROPERTIES		MEASUREMENT		GEOMETRY		GRAPHING	
1	86.4%	1	66.5%	1	84.4%	1	92.0%	1	60.8%
2	71.2%	2	72.2%	2	77.0%	2	82.8%	2	64.9%
3	73.8%	3	84.7%	3	81.6%	3	70.4%	3	83.2%
4	47.8%	4	69.1%	4	72.3%	4	49.5%	4	77.3%
5	75.3%	5	61.8%	5	41.0%				
6	74.1%	6	70.8%	6	73.5%				
7	75.7%	7	66.9%	7	56.0%				
		8	83.5%	8	90.1%				
		9	54.7%	9	43.1%				
AVG	71.9%		72.5%		68.8%		73.7%		71.5%

earlier in the former Alberta programs with little success. Figure 52 indicates that eighty percent of the pupils now achieve within categories C and D.

TABLE 12

ACHIEVEMENT MEANS IN 1978 AND 1979 WITHIN CATEGORIES A-D FOR THE NUMBER, OPERATIONS AND PROPERTIES, AND MEASUREMENT STRANDS

```
   _ZONE_ONE__PUPILS_IN_1978_AND_1979_ACHIEVING_WITHIN_EACH_CATAGORY_A-D_
       CRITERION CATEGORIES FOR  GRADE:3  STRAND: NUMBER
           TOTAL NUMBER OF PUPILS:  1978 N=1912    1979 N=1810

           A: BELOW 50%       B:  50-64%        C:  65-84%       D: 85-100%
       ____1978____1979_____1978____1979_____1978____1979_____1978____1979_
NUMBER(%)  19.25    15.86    16.37    16.96    31.54    32.76    32.85    34.42
MEAN (%)   35.04    35.61    57.58    57.66    74.61    74.49    92.69    93.18

            TABLES COMPARING 1978 AND 1979 MEAN SCORES AND PROPORTIONS
    ___PROPORTION TEST___ #  ____________________F-TEST______________________
    HO: PROPOR78=PROPOR79 #  ________SS________  ______DF______
     _T-CALC____DF____PROB_#__BETWEEN______WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
A:     2.718   3720   0.007 #     51.60   87134.81     1      653     0.387   0.534
B:    -0.484   3720   0.629 #      0.92   10680.55     1      618     0.053   0.817
C:    -0.800   3720   0.424 #      4.21   39008.39     1     1194     0.129   0.720
D:    -1.016   3720   0.310 #     67.27   27260.01     1     1249     3.082   0.079

   _ZONE_ONE__PUPILS_IN_1978_AND_1979_ACHIEVING_WITHIN_EACH_CATAGORY_A-D_
       CRITERION CATEGORIES FOR  GRADE:3  STRAND: OPERATIONS & PROPERTIES
           TOTAL NUMBER OF PUPILS:  1978 N=1912    1979 N=1810

           A: BELOW 50%       B:  50-64%        C:  65-84%       D: 85-100%
       ____1978____1979_____1978____1979_____1978____1979_____1978____1979_
NUMBER(%)  12.29    10.44    15.12    17.85    41.06    44.14    31.54    27.57
MEAN (%)   36.19    34.51    58.44    58.25    75.22    75.62    91.02    90.99

            TABLES COMPARING 1978 AND 1979 MEAN SCORES AND PROPORTIONS
    ___PROPORTION TEST___ #  ____________________F-TEST______________________
    HO: PROPOR78=PROPOR79 #  ________SS________  ______DF______
     _T-CALC____DF____PROB_#__BETWEEN______WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
A:     1.774   3720   0.076 #    294.98   66589.96     1      422     1.869   0.172
B:    -2.246   3720   0.025 #      5.25    9803.23     1      610     0.327   0.568
C:    -1.904   3720   0.057 #     64.65   47154.07     1     1582     2.169   0.141
D:     2.651   3720   0.008 #      0.28   19436.77     1     1100     0.016   0.900

   _ZONE_ONE__PUPILS_IN_1978_AND_1979_ACHIEVING_WITHIN_EACH_CATAGORY_A-D_
       CRITERION CATEGORIES FOR  GRADE:3  STRAND: MEASUREMENT
           TOTAL NUMBER OF PUPILS:  1978 N=1912    1979 N=1810

           A: BELOW 50%       B:  50-64%        C:  65-84%       D: 85-100%
       ____1978____1979_____1978____1979_____1978____1979_____1978____1979_
NUMBER(%)  16.53    16.24    24.16    19.78    38.28    39.67    21.03    24.31
MEAN (%)   33.53    32.51    57.85    57.58    74.88    75.04    91.29    91.88

            TABLES COMPARING 1978 AND 1979 MEAN SCORES AND PROPORTIONS
    ___PROPORTION TEST___ #  ____________________F-TEST______________________
    HO: PROPOR78=PROPOR79 #  ________SS________  ______DF______
     _T-CALC____DF____PROB_#__BETWEEN______WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
A:     0.234   3720   0.815 #    155.60  129965.40     1      608     0.728   0.394
B:     3.226   3720   0.001 #     18.48   16707.13     1      818     0.905   0.342
C:    -0.865   3720   0.387 #      9.46   44256.33     1     1448     0.309   0.578
D:    -2.394   3720   0.017 #     74.91   18041.60     1      840     3.488   0.062
```

TABLE 13

ACHIEVEMENT MEANS IN 1978 AND 1979 WITHIN CATEGORIES A-D FOR THE GEOMETRY AND GRAPHING STRANDS

```
     _ZONE_ONE__PUPILS_IN_1978_AND_1979_ACHIEVING_WITHIN_EACH_CATAGORY_A-D_
          CRITERION CATEGORIES FOR  GRADE:3  STRAND: GEOMETRY
                TOTAL NUMBER OF PUPILS:  1978 N=1912'   1979 N=1810

             A: BELOW 50%      B:  50-64%        C:  65-84%        D: 85-100%
         ____1978____1979_____1978____1979_____1978____1979_____1978____1979_
NUMBER(%)    9.10    10.17     22.59   20.28     29.50   29.85     38.81   39.67
MEAN (%)    29.74    27.66     57.56   57.80     73.82   74.30     92.77   93.14

              TABLES COMPARING 1978 AND 1979 MEAN SCORES AND PROPORTIONS
     ___PROPORTION TEST___ #  ______________________F-TEST________________________
     HC: PROPOR78=PROPOR79 #  _________SS________  ______DF______
     _T-CALC____DF____PROB_#__BETWEEN______WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
A:   -1.102   3720   0.271 #    388.45   72471.43     1       355     1.908  0.168
B:    1.721   3720   0.086 #     11.44   23507.67     1       757     0.388  0.534
C:   -0.261   3720   0.754 #     63.70   17732.42     1      1103     3.962  0.047
D:   -0.538   3720   0.591 #     48.81   51757.22     1      1458     1.375  0.241


     _ZONE_ONE__PUPILS_IN_1978_AND_1979_ACHIEVING_WITHIN_EACH_CATAGORY_A-D_
          CRITERION CATEGORIES FOR  GRADE:3  STRAND: GRAPHING
                TOTAL NUMBER OF PUPILS:  1978 N=1912    1979 N=1810

             A: BELOW 50%      B:  50-64%        C:  65-84%    -   D: 85-100%
         ____1978____1979_____1978____1979_____1978____1979_____1978____1979_
NUMBER(%)   26.83    19.12     17.83   13.26     24.90   25.86     30.44   41.77
MEAN (%)    27.32    27.90     56.23   56.86     73.89   73.86     94.60   94.72

              TABLES COMPARING 1978 AND 1979 MEAN SCORES AND PROPORTIONS
     ___PROPORTION TEST___ #  ______________________F-TEST________________________
     HC: PROPOR78=PROPOR79 #  _________SS________  ______DF______
     _T-CALC____DF____PROB_#__BETWEEN______WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
A:    5.583   3720   0.000 #     70.03  197263.68     1       857     0.304  0.581
B:    3.844   3720   0.000 #     56.06    9208.25     1       579     3.487  0.062
C:   -0.673   3720   0.501 #      0.12   37721.99     1       942     0.003  0.956
D:   -7.199   3720   0.000 #      4.99   32710.58     1      1336     0.204  0.652
```

Operations and Properties

Although this strand appears heavy at the grade three level, pupil achievement is good for the majority of objectives. However level three pupils still appear to confuse the four operations. Only about sixty percent of the group could recognize additive, subtractive, multiplicative and divisive situations with any degree of accuracy. Reading ability, the often cited weakness, was not the cause since teachers read the mathematics stories out loud. The data from the items where pupils were required to identify related sentences and solve word problems (Figures 66 and 67), supports to the idea that better understanding of the operations is required.

Since only about one-third of the pupils mastered the basic facts involving sums, minuends, products and dividends to 18, one might expect some problems with the algorithms. This was not the case however as pupils were able to add and subtract two and three digit numbers with more success than the one digit facts. One explanation may be that pupils spend a fair amount of time in the operations without a committment of the basic facts to memory.

Measurement

The difficulties that pupils have had with money became more evident at the grade three level. The weakness appears to be more on making change and not so much on the actual counting of coin collections. Perhaps the demands made of pupils in these items are similar to those in problem solving. In fact the two items used to measure the 'making purchase and change' skills involve a sequence of operations; subtraction first then addition.

The significant increase in the 1979 performance on reciting the months of the year in order may be an indication that this topic received little emphasis previously.

It is not clear from the analysis in Figure 74 whether the difficulties pupils are having are with the estimation or the measurement skills. The weakness is more than likely with the estimating of lengths.

Although grade three children improved from 1978 to 1979 at expressing linear measurement to tenths the large proportion of zero scores may indicate that the decimal aspect of metric measurement is not emphasized. Decimal conversion from the common fraction could be the alternative that teachers use.

Geometry

The requirement in the grade three objectives of classifying or identifying 2-dimensional figures and 3-dimensional objects are similar to those for grade two. The items at the grade three level however appear easier than the one for grade two. This likely distorts the achievement picture somewhat.

The objective on recognizing corresponding parts in polygon's does not stipulate whether the polygons are to be transformed in any way. Achievement on the item in Figure 80 would likely be different had the polygons not been rotated.

Graphing

It is interesting to note that the greatest 1979 gains were made on the Graphing strand. Apparently more time has been devoted to the concept of ordered pairs and the quadrant.

Suprisingly many pupils have problems in constructing a graph even given the data. Students may lack the experience of translating the numeric informatin to graphic form.

CHAPTER VII

GRADE FOUR

ANALYSIS OF OBJECTIVES ONE AND TWO FOR GRADE FOUR

NUMBER (Nine objectives; Figures 87 to 95)

Hypothesis 1

None of the objectives had performances where eighty percent of the Zone One pupils in 1978 and 1979 were within the 85-100 percent category.

Hypothesis 2

Eight objectives had significant increases in the proportion of students achieving to the 85-100 percent level in 1979 over 1978.

Findings

Five of the number objectives relate to place value skills; three of these involve decimals to hundredths and all five report rather low achievement ratings.

Although ten percent more pupils in 1979 than in 1978 could identify and use the place value of digits (Figure 87), still about four pupils in ten could not do so. The same proportion of students had similar achievement figures for reading and writing decimals to hundredths.

Most pupils (eighty-four percent) failed to correctly answer any of the items involving regrouping numbers to tenths and hundredths. Forty-three percent of the pupils could not regroup 5-digit whole numbers nor rewrite them in

- PART I -

PART	QUESTION	STRAND	OBJECTIVE	RAW SCORE VALUE
I	1	Number	1	10
I	2	Number	1	14
I	3	Number	2	10
I	4	Number	2	10
I	5	Number	3	10
I	6	Number	3	10
I	7	Number	4	15
I	8	Number	5	15
I	9	Number	6	4
I	10	Number	6	4
I	11	Number	6	4
I	12	Number	7	12
I	13	Number	8	12
I	14	Number	9	10

- PART II -

PART	QUESTION	STRAND	OBJECTIVE	RAW SCORE VALUE
II	15	Op. & Prop.	1	8
II	16	Op. & Prop.	2	4
II	17	Op. & Prop.	2	4
II	18	Op. & Prop.	3	9
II	19	Op. & Prop.	4	10
II	20	Op. & Prop.	5	10
II	21	Op. & Prop.	6	9
II	22	Op. & Prop.	6	9
II	23	Op. & Prop.	7	6
II	24	Op. & Prop.	7	6
II	25	Op. & Prop.	8	8
II	26	Op. & Prop.	9	4
II	27	Op. & Prop.	9	5
II	28	Op. & Prop.	10	8

FIGURE 85

GRADE FOUR DETAILED ANALYSIS OF MARK WEIGHTINGS

- PART III -

PART	QUESTION	STRAND	OBJECTIVE	RAW SCORE VALUE
III	1	Measurement	1	5
III	2	Measurement	2	5
III	3	Measurement	3	18
III	4	Measurement	4	8
III	5	Measurement	5	8
III	6	Measurement	6	6
III	7	Measurement	7	4
III	8	Measurement	7	2
III	9	Measurement	8	4
III	10	Measurement	8	4
III	11	Measurement	9	8

- PART IV -

PART	QUESTION	STRAND	OBJECTIVE	RAW SCORE VALUE
IV	12	Geometry	1	14
IV	13	Geometry	2	20
IV	14	Geometry	3	6
IV	15	Geometry	3	4
IV	16	Geometry	3	4
IV	17	Graphing	1	5
IV	18	Graphing	1	5
IV	19	Graphing	1	5
IV	20	Graphing	2	8
IV	21	Graphing	2	10
IV	22	Graphing	3	3
IV	23	Graphing	4	4

FIGURE 86

GRADE FOUR DETAILED ANALYSIS OF MARK WEIGHTINGS

LEVEL D (Grade 4)

NUMBER

OBJECTIVE I *Identifies and uses place value of digits (0.01 - 99 000).*

TEST ITEMS

1. Write the following numbers containing:

(a) 4 hundreds
2 tens
8 ones
5 tenths

____

(b) 6 hundreds
2 tens
5 ones
6 tenths
1 hundredths

____

2. For the number, 75 896.01, show:

How many in the thousands place? ________

How many in the ones place? ________

How many in the ten thousands place? ________

How many in the tenths place? ________

How many in the tens place? ________

How many in the hundreds place? ________

How many in the hundredths place? ________

ANALYSIS

```
  _ZONE_ONE__PUPILS_IN_1978_AND_1979_ACHIEVING_WITHIN_EACH_CATAGORY_A-D_
      CRITERION CATEGORIES FOR     GRADE:4   STRAND:1   OBJECTIVE: 1
            TOTAL NUMBER OF PUPILS:  1978 N=2115    1979 N=1969

          A: BELOW 50%        B:  50-64%          C:  65-84%          D: 85-100%
        ----1978----1979-----1978----1979-----1978----1979-----1978----1979-
NUMBER(%)  51.96    39.56     10.97    11.99     10.21    10.82     26.86    37.63
MEAN (%)   14.77    15.57     56.43    56.27     77.24    78.15     99.21    99.23

               TABLES COMPARING 1978 AND 1979 MEAN SCORES AND PROPORTIONS
   ___PROPORTION TEST___ #  ____________________F-TEST_________________________
   HO: PROPOR78=PROPOR79 #  ________SS_________  ______DF______
   _T-CALC____DF____PROB_#__BETWEEN_____WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
A:    7.944  4082   0.000 #    291.15  429818.98     1       1876     1.271  0.260
B:   -1.019  4082   0.308 #      3.07    8898.69     1        466     0.161  0.689
C:   -0.630  4082   0.529 #     89.16   12830.02     1        427     2.967  0.086
D:   -7.375  4082   0.000 #      0.15    7728.05     1       1307     0.026  0.872


   ______COMPARING_THE_MEAN_SCORES_OF_PUPILS_WITHIN_ZONE_SUBGROUPS_______
                                    ___________________F-TEST TABLE___________________
GROUPS          YEARS        #  _________SS_________  ______DF______
======______1978____1979__#__BETWEEN_____WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
EARLY          45.77    57.13 #  87241.97 4076031.23     1       2710    58.004  0.000
LATE           53.48    63.53 #  32580.64 1862516.05     1       1268    22.531  0.000
MALE           48.36    57.62 #  45845.45 3198887.44     1       2129    30.655  0.000
FEMALE         48.43    59.93 #  64071.44 2909716.20     1       1941    42.740  0.000
NORTH          42.69    50.33 #  21029.22 2118395.74     1       1446    14.354  0.000
SOUTH          51.69    63.05 #  84898.82 3881476.39     1       2634    57.613  0.000
PUBLIC         48.32    59.28 #  99141.19 4950641.55     1       3308    66.186  0.000
SEPARATE       48.73    56.33 #  11200.76 1187832.56     1        775     7.497  0.006
```

FIGURE 87

LEVEL D (Grade 4)

NUMBER

OBJECTIVE 2 *Regroups 5-digit whole numbers and rewrites in expanded notation.*

TEST ITEMS

3. Fill in the blanks:

65 957 = 6 X ______ + 5 X ______ + 9 X ______

+ ______ X 10 + ______ X 1

4. Fill in the blanks:

19 048 = ______ X 10 000 + ______ X 1 000

+ ______ X 100 + 4 X ______ + ______ X 1

ANALYSIS

```
 _ZONE_ONE__PUPILS_IN_1978_AND_1979_ACHIEVING_WITHIN_EACH_CATAGORY_A-D_
     CRITERION CATEGORIES FOR     GRADE:4    STRAND:1    OBJECTIVE: 2
           TOTAL NUMBER OF PUPILS:  1978 N=2115     1979 N=1969

           A: BELOW 50%        B:  50-64%        C:  65-84%         D: 85-100%
       ____1978____1979_____1978____1979_____1978____1979_____1978____1979_
NUMBER(%)  53.90    43.47    12.25    11.12     9.83    10.92    24.02    34.48
MEAN (%)   11.50    13.10    56.78    56.26    73.70    75.05    96.92    97.53

            TABLES COMPARING 1978 AND 1979 MEAN SCORES AND PROPORTIONS
   ___PROPORTION TEST___ #   ____________________F-TEST_______________________
   HO: PROPOR78=PROPOR79 #   _________SS________  ______DF______
   _T-CALC____DF____PROB_#__BETWEEN_____WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
A:    6.661   4082   0.000 #    1247.28  477035.14     1       1994    5.214  0.023
B:    1.116   4082   0.265 #      32.13   10662.69     1        476    1.434  0.232
C:   -1.137   4082   0.256 #     191.14   10299.05     1        421    7.813  0.005
D:   -7.360   4082   0.000 #     106.89   23396.99     1       1185    5.413  0.020

  ______COMPARING_THE_MEAN_SCORES_OF_PUPILS_WITHIN_ZONE_SUBGROUPS_______
                               ___________________F-TEST TABLE_________________
GROUPS         YEARS       #   _________SS_________  ______DF______
======_____1978____1979__#__BETWEEN_____WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
EARLY       42.20    51.20 #  54671.31 4104004.64     1       2710   36.101  0.000
LATE        46.52    58.70 #  47827.44 1932166.44     1       1288   31.882  0.000
MALE        42.71    51.66 #  42787.16 3190384.44     1       2139   28.687  0.000
FEMALE      44.72    56.19 #  63823.20 2985203.92     1       1941   41.498  0.000
NORTH       36.81    43.95 #  18322.53 2112778.84     1       1446   12.540  0.000
SOUTH       47.65    58.89 #  83115.52 3918457.51     1       2634   55.871  0.000
PUBLIC      44.52    53.72 #  69682.65 5055584.99     1       3305   45.685  0.000
SEPARATE    39.99    54.02 #  38228.67 1125650.84     1        775   26.318  0.000
```

FIGURE 88

LEVEL D (Grade 4)

NUMBER

OBJECTIVE 3 *Rounds whole numbers (limit: 3-digit accuracy).*

TEST ITEMS

5. Round to the nearest thousand (1 000).

a. 1 459 ____________

b. 39 102 ____________

c. 89 927 ____________

d. 9 999 ____________

e. 999 ____________

6. Round to the nearest dollar.

a. $101.49 $___________

b. $349.16 $___________

c. $ 7.51 $___________

d. $ 99.81 $___________

e. $ .75 $___________

ANALYSIS

```
_ZONE_ONE__PUPILS_IN_1978_AND_1979_ACHIEVING_WITHIN_EACH_CATAGORY_A-D_
      CRITERION CATEGORIES FOR     GRADE:4   STRAND:1   OBJECTIVE: 3
            TOTAL NUMBER OF PUPILS:  1978 N=2115    1979 N=1969

            A: BELOW 50%       B:  50-64%        C:  65-84%        D: 85-100%
        ____1978____1979_____1978____1979______1978____1979_____1978____1979_
NUMBER(%)   53.81    45.15    15.84    16.56     13.43    16.86    16.93    21.43
MEAN (%)    16.04    17.75    54.60    54.69     74.58    74.71    96.37    96.48

            TABLES COMPARING 1978 AND 1979 MEAN SCORES AND PROPORTIONS
   ___PROPORTION TEST___ #  ____________________F-TEST______________________
   HO: PROPOR78=PROPOR79 #  _________SS________  ______DF______
   _T-CALC____DF____PROB_#__BETWEEN_____WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
A:    5.529  4082   0.000 #   1457.69  458041.62     1      2025     6.444  0.011
B:   -0.622  4082   0.534 #      1.53   16439.92     1       659     0.061  0.804
C:   -3.064  4082   0.002 #      2.85   15247.11     1       614     0.115  0.735
D:   -3.660  4082   0.000 #      2.44   17278.68     1       778     0.106  0.744

   ______COMPARING_THE_MEAN_SCORES_OF_PUPILS_WITHIN_ZONE_SUBGROUPS_______
                                ___________________F-TEST TABLE_________________
GROUPS        YEARS        #  _________SS_________  ______DF______
======_____1978____1979__#__BETWEEN_____WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
EARLY        42.12    48.36 #  26254.56 3116407.82     1      2710    22.831  0.000
LATE         46.53    54.79 #  22011.44 1498065.23     1      1288    18.925  0.000
MALE         46.20    51.49 #  14971.95 2495707.78     1      2139    12.832  0.000
FEMALE       40.83    49.04 #  32675.46 2214002.23     1      1941    28.646  0.000
NORTH        38.83    40.76 #   1344.50 1704095.01     1      1446     1.141  0.286
SOUTH        46.37    55.32 #  52827.94 2901826.03     1      2634    47.952  0.000
PUBLIC       44.13    51.05 #  39506.34 3916202.33     1      2305    33.341  0.000
SEPARATE     41.28    47.45 #   7393.17  805022.08     1       775     7.117  0.008
```

FIGURE 89

LEVEL D (Grade 4)

NUMBER

OBJECTIVE 4 *Identifies, reads and writes a fraction to represent a point on a number line or a region with emphasis on halves, quarters, fifths and tenths.*

TEST ITEMS

7. Colour in two fifths of the box below.

Write the fractional number for the space that you did not colour in.

____

ANALYSIS

```
_ZONE_ONE__PUPILS_IN_1978_AND_1979_ACHIEVING_WITHIN_EACH_CATAGORY_A-D_
      CRITERION CATEGORIES FOR     GRADE:4   STRAND:1   OBJECTIVE: 4
           TOTAL NUMBER OF PUPILS:  1978 N=2115    1979 N=1969

           A: BELOW 50%       B:  50-64%        C:  65-84%        D: 85-100%
       ----1978____1979_____1978____1979_____1978____1979_____1978____1979_
NUMBER(%)  11.21     8.89    27.75    26.00     0.09    0.10    60.95   65.01
MEAN (%)    6.81     9.94    53.33    53.35    70.00   66.67    99.97   99.97

           TABLES COMPARING 1978 AND 1979 MEAN SCORES AND PROPORTIONS
  ___PROPORTION TEST___ #  ____________________F-TEST______________________
  HO: PROPOR78=PROPOR79 #  ________SS________  ______DF______
  _T-CALC____DF____PROB_#__BETWEEN_____WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
A:   2.458  4082   0.014 #    989.73  118783.63    1     410     3.416  0.065
B:   1.261  4082   0.208 #      0.05      44.36    1    1097     1.147  0.285
C:  -0.072  4082   0.943 #     11.11      22.22    1       2     1.000  0.423
D:  -2.685  4082   0.007 #      0.02     753.44    1    2567     0.064  0.801

  ------COMPARING_THE_MEAN_SCORES_OF_PUPILS_WITHIN_ZONE_SUBGROUPS______
                           ___________________F-TEST TABLE__________________
GROUPS        YEARS      #  ________SS________  ______DF______
======_____1978____1979__#__BETWEEN_____WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
EARLY       74.54   78.90 #  12802.49 2889585.57    1    2710   12.007  0.001
LATE        81.08   81.97 #    201.93 1053755.17    1    1288    0.247  0.619
MALE        75.36   77.84 #   3304.28 2203656.54    1    2139    3.207  0.074
FEMALE      77.85   82.05 #   8550.12 1813843.80    1    1941    9.150  0.003
NORTH       71.11   73.53 #   2105.09 1698200.74    1    1446    1.792  0.181
SOUTH       79.71   83.07 #   7435.76 2254643.67    1    2634    8.687  0.003
PUBLIC      78.54   80.27 #   2474.43 3096128.43    1    3305    2.641  0.105
SEPARATE    67.83   77.91 #  19752.30  894968.62    1     775   17.104  0.000
```

FIGURE 90

LEVEL D (Grade 4)

NUMBER

OBJECTIVE 5 *Identifies equivalence. Generates equivalent fractions for halves, quarters, fifths, tenths and hundredths.*

TEST ITEMS

8. Make three equivalent fractions for each given fraction below:

A. 1/2 ________ ________ ________
B. 2/4 ________ ________ ________
C. 3/10 ________ ________ ________
D. 2/5 ________ ________ ________
E. 5/100 ________ ________ ________

ANALYSIS

```
    _ZONE_ONE__PUPILS_IN_1978_AND_1979_ACHIEVING_WITHIN_EACH_CATAGORY_A-D_
        CRITERION CATEGORIES FOR    GRADE:4   STRAND:1   OBJECTIVE: 5
             TOTAL NUMBER OF PUPILS:  1978 N=2115   1979 N=1969

          A: BELOW 50%       B:  50-64%       C:  65-84%        D: 85-100%
       ____1978____1979_____1978____1979_____1978____1979_____1978____1979_
NUMBER(%)  65.58   56.37     4.26    5.38     7.71   10.16    22.46   28.09
MEAN (%)   11.87   13.68    56.89   57.23    75.09   74.87    96.52   96.75

            TABLES COMPARING 1978 AND 1979 MEAN SCORES AND PROPORTIONS
    ___PROPORTION TEST___ #  _________________F-TEST______________________
    HO: PROPOR78=PROPOR79 #  ________SS________  ______DF______
    _T-CALC____DF____PROB_#__BETWEEN_____WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
A:    6.031  4082   0.000 #   2005.52  657486.35     1      2455    7.610  0.006
B:   -1.685  4082   0.092 #      5.75    2139.37     1       194    0.522  0.471
C:   -2.750  4082   0.006 #      4.56   11158.95     1       361    0.148  0.701
D:   -4.140  4082   0.000 #     13.02   27408.51     1      1026    0.487  0.485

    ______COMPARING_THE_MEAN_SCORES_OF_PUPILS_WITHIN_ZONE_SUBGROUPS_______
                             ___________________F-TEST TABLE_________________
GROUPS        YEARS        #  ________SS________  ______DF______
======_____1978_____1979__#__BETWEEN_____WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
EARLY       35.41    42.24 #  31548.79 4093377.01    1      2710   20.887  0.000
LATE        42.18    51.38 #  27288.05 2019980.99    1      1288   17.400  0.000
MALE        37.35    43.49 #  20164.89 3266103.38    1      2139   13.206  0.000
FEMALE      38.02    47.93 #  47637.59 3015258.73    1      1941   30.666  0.000
NORTH       31.99    31.35 #    147.19 2050007.26    1      1446    0.104  0.747
SOUTH       40.96    52.95 #  94747.96 3995251.08    1      2634   62.466  0.000
PUBLIC      39.01    43.78 #  18788.18 5096062.55    1      3305   12.185  0.001
SEPARATE    31.78    52.90 #  86640.82 1182764.52    1       775   58.248  0.000
```

FIGURE 91

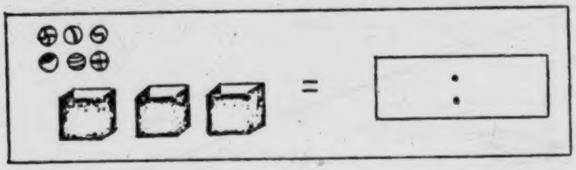
LEVEL D (Grade 4)

NUMBER

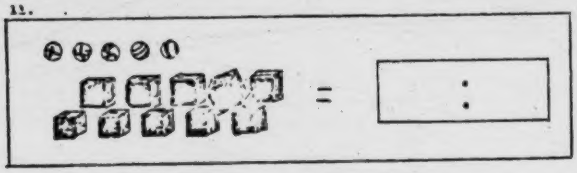
OBJECTIVE 6 *Interprets simple ratio situations.*

TEST ITEMS

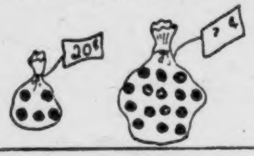
10. Use numbers to show the ratio of <u>marbles</u> <u>to</u> <u>blocks</u> for each picture below:



11.



9. Fill in the amount of money needed for 15 gum.



5 gum | 20 | cents

15 gum | | cents

Put answer here

ANALYSIS

```
 _ZONE_ONE__PUPILS_IN_1978_AND_1979_ACHIEVING_WITHIN_EACH_CATAGORY_A-D_
       CRITERION CATEGORIES FOR      GRADE:4    STRAND:1    OBJECTIVE: 6
            TOTAL NUMBER OF PUPILS:  1978 N=2115    1979 N=1565

            A: BELOW 50%        B:  50-64%         C:  65-84%         D: 85-100%
         ____1978____1979_____1978____1979_____1978____1979_____1978____1979_
NUMBER(%)  40.52    36.47      0.28     0.86     28.32    29.61     30.87    33.06
MEAN (%)   16.74    19.12     50.00    50.00     66.90    66.77    100.00    99.97

          TABLES COMPARING 1978 AND 1979 MEAN SCORES AND PROPORTIONS
   ___PROPORTION TEST___  #  ______________________F-TEST_______________________
   HO: PROPOR78=PROPOR79  #  _________SS_________  ______DF______
   _T-CALC____DF____PROB_#__BETWEEN______WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
A:   2.660  4082   0.008 #   2196.54  428536.00     1      1573     8.063  0.005
B:  -2.474  4082   0.013 # <<<<<<<<<<<<<< SSW IS EQUAL TO ZERO >>>>>>>>>>>>>>
C:  -0.907  4082   0.365 #      5.50    3155.10     1      1160     2.057  0.152
D:  -1.499  4082   0.134 #      0.21     138.46     1      1302     2.009  0.157


     ______COMPARING_THE_MEAN_SCORES_OF_PUPILS_WITHIN_ZONE_SUBGROUPS_______
                             ____________________F-TEST TABLE_________________
GROUPS        YEARS       #  _________SS_________  ______DF______
======_____1978____1979__#__BETWEEN______WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
EARLY       55.70   57.88 #   3222.07 3564202.31     1      2710     2.450  0.118
LATE        58.05   65.61 #  18433.07 1644780.54     1      1288    14.435  0.000
MALE        56.53   59.24 #   3939.18 2838972.88     1      2139     2.968  0.085
FEMALE      56.99   61.35 #   9202.33 2514372.25     1      1941     7.104  0.008
NORTH       54.47   49.47 #   9025.13 1957705.18     1      1446     6.666  0.010
SOUTH       58.07   65.81 #  39524.74 3273261.89     1      2634    31.806  0.000
PUBLIC      57.16   60.19 #   7564.59 4291838.69     1      3305     5.825  0.016
SEPARATE    54.94   60.38 #   5747.68 1062219.58     1       775     4.194  0.041
```

FIGURE 92

LEVEL D (Grade 4)

NUMBER

OBJECTIVE 7 *Reads and writes decimals to hundredths.*

TEST ITEMS

12. Fill in the blanks:

A. 47 hundredths = ________ tenths +
________ hundredths

B. 52 hundredths = ________ tenths +
________ hundredths

C. 7 hundredths = ________ tenths +
________ hundredths

ANALYSIS

```
_ZONE_ONE__PUPILS_IN_1978_AND_1979_ACHIEVING_WITHIN_EACH_CATAGORY_A-D_
      CRITERION CATEGORIES FOR    GRADE:4   STRAND:1   OBJECTIVE: 7
          TOTAL NUMBER OF PUPILS:  1978 N=2115   1979 N=1969

            A: BELOW 50%       B:  50-64%        C:  65-84%        D: 85-100%
        ____1978____1979_____1978____1979_____1978____1979_____1978____1979_
NUMBER(%)  51.73   42.51     2.17     2.03     17.02    17.93     29.08    37.53
MEAN (%)   13.48   15.51    50.00    50.00     70.88    71.08    100.00    99.97

           TABLES COMPARING 1978 AND 1979 MEAN SCORES AND PROPORTIONS
   ___PROPORTION TEST___ #  ____________________F-TEST_______________________
   HO: PROPOR78=PROPOR79 #  _________SS________  ______DF______
   _T-CALC____DF____PROB_#__BETWEEN______WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
A:    5.895  4082   0.000 #   1967.11  427392.17    1      1929    8.878  0.003
B:    0.319  4082   0.750 #  <<<<<<<<<<<<<< SSW IS EQUAL TO ZERO >>>>>>>>>>>>>>
C:   -0.763  4082   0.446 #      7.24   37911.57    1       711    0.136  0.713
D:   -5.734  4082   0.000 #      0.38     207.49    1      1352    2.503  0.114

   ______COMPARING_THE_MEAN_SCORES_OF_PUPILS_WITHIN_ZONE_SUBGROUPS______
                                    ___________________F-TEST TABLE___________________
GROUPS          YEARS       #   _________SS________  ______DF______
======_____1978____1979__#__BETWEEN______WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
EARLY       47.36   56.65 #  58363.94 4347402.61    1      2710   36.382  0.000
LATE        53.84   61.04 #  16714.38 2012344.67    1      1288   10.698  0.001
MALE        46.20   54.01 #  32651.69 3382555.84    1      2139   20.648  0.000
FEMALE      52.41   62.27 #  47055.79 3057070.42    1      1941   29.877  0.000
NORTH       43.81   50.28 #  15117.36 2330841.38    1      1446    9.378  0.002
SOUTH       52.32   61.81 #  59362.26 4068217.94    1      2634   38.435  0.000
PUBLIC      50.96   57.60 #  36381.42 5326446.13    1      3305   22.574  0.000
SEPARATE    41.43   58.98 #  59818.67 1137524.93    1       775   40.755  0.000
```

FIGURE 93

LEVEL D (Grade 4)

NUMBER

OBJECTIVE 8 *Regroups tenths and hundredths.*

TEST ITEMS

13. Write these numbers:

A. 6 ones, 8 tenths, 13 hundredths ______________

B. 2 ones, 12 tenths, 7 hundredths ______________

C. 5 ones, 11 tenths, 14 hundredths ______________

ANALYSIS

```
_ZONE_ONE__PUPILS_IN_1978_AND_1979_ACHIEVING_WITHIN_EACH_CATAGCRY_A-D_
     CRITERION CATEGCRIES FOR    GRADE:4   STRAND:1   OEJECTIVE: 8
          TOTAL NUMEER OF PUPILS:  1978 N=2115   1979 N=1969

            A: BELOW 50%      B:  50-64%       C:  65-84%       D: 85-100%
        ----1978____1979_____1978____1979_____1978____1979_____1978____1979_
NUMBER(%)  91.06    84.05     0.0      0.56     2.17     3.96     6.76    11.43
MEAN (%)    1.51     2.25   ******    50.00    66.85    66.99   100.00   100.00

          TABLES CCMPARING 1978 AND 1979 MEAN SCORES AND PROPCRTIONS
   ___PROPCRTION TEST___ #  ____________________F-TEST_________________________
   HC: PRCPOR78=PROPOR79 #  _________SS________  ______DF______
   _T-CALC____DF____PRCB_#__BETWEEN_____WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
A:    6.813   4082    0.000 #    476.11  205153.18     1      3579    8.306  0.004
B:   -3.442   4082    0.001 #  <<<<<<<< TOC FEW PUPILS FOR CALCULATICNS >>>>>>>>
C:   -3.325   4082    0.001 #      0.56     407.14     1       122    0.168  0.682
D:   -5.203   4082    0.000 #  <<<<<<<<<<<<<< SSW IS EQUAL TO ZERC >>>>>>>>>>>>>>

   ------COMPARING_THE_MEAN_SCORES_OF_PUPILS_WITHIN_ZONE_SUBGROUPS______
                                  ___________________F-TEST TABLE________________
GROUPS         YEARS        #  _________SS________  ______DF______
======______1978_____1979__#__BETWEEN_____WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
EARLY           8.80    13.37 #  14152.25 2145698.31    1       2710   17.841  0.000
LATE           10.82    22.28 #  42356.68 1491308.32    1       1288   36.582  0.000
MALE           10.32    14.78 #  10636.81 1919033.25    1       2139   11.856  0.001
FEMALE          8.81    17.92 #  40124.14 1841869.20    1       1941   42.284  0.000
NORTH           6.95     9.68 #   2697.90  865755.14    1       1446    4.506  0.034
SOUTH          11.13    19.66 #  47947.47 2848521.61    1       2634   44.337  0.000
PUBLIC          9.81    16.22 #  33924.62 3096352.57    1       3305   36.211  0.000
SEPARATE        8.65    16.36 #  11550.72  670133.11    1        775   13.358  0.000
```

FIGURE 94

LEVEL D (Grade 4)

NUMBER

OBJECTIVE 9 *Expresses and generates proportional ratios.*

TEST ITEMS

14. Fill in the boxes:

A. $\frac{2}{3} :: \frac{\square}{6}$

B. $\frac{3}{4} :: \frac{9}{\square}$

C. $\frac{2}{5} :: \frac{\square}{10}$

D. $\frac{6}{8} :: \frac{\square}{32}$

E. $\frac{3}{10} :: \frac{\square}{40}$

ANALYSIS

```
 _ZCNE_ONE__PUPILS_IN_1978_AND_1979_ACHIEVING_WITHIN_EACH_CATAGCRY_A-D_
      CRITERION CATEGCRIES FOR     GRADE:4   STRAND:1   CEJECTIVE: 9
            TOTAL NUMBER OF PUPILS:  1978 N=2115    1979 N=1969

           A: BELOW 50%       B:  50-64%         C:  65-84%        D: 85-100%
       ____1978____1979_____1978____1979_____1978____1979_____1978____1979_
NUMBER(%)  57.87    51.90     5.91     7.16      8.56     8.58     27.66    32.35
MEAN (%)   11.68    12.07    60.00    59.86     80.00    80.00    100.00   100.00

              TABLES COMPARING 1978 AND 1979 MEAN SCORES AND PRCPCRTIONS
    ___PROPORTICN TEST___ #  _____________________F-TEST______________________
    HC: FRCPOR78=PROPOR79 #  _________SS________  ______DF______
    _T-CALC____DF____PROB_#__BETWEEN_____WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
A:    3.831   4082   0.000 #     85.30  586935.35    1       2244      0.326  0.568
B:   -1.619   4082   0.106 #      1.33     197.16    1        264      1.785  0.183
C:   -0.029   4082   0.977 #  <<<<<<<<<<<<<< SSW IS EQUAL TO ZERO >>>>>>>>>>>>>>
D:   -3.272   4082   0.001 #  <<<<<<<<<<<<<< SSW IS EQUAL TC ZERO >>>>>>>>>>>>>>


     ______COMPARING_THE_MEAN_SCORES_OF_PUPILS_WITHIN_ZONE_SUBGROUPS_______
                             ____________________F-TEST TABLE__________________
GROUPS           YEARS      #  _________SS_________  ______DF______
======_____1978____1979__#__BETWEEN_____WITHIN__BETWEEN_WITHIN__F-RATIC__PROB
EARLY        42.99    46.07 #   6422.37 4737547.98      1      2710      3.674  0.055
LATE         49.25    57.15 #  20112.12 2282801.37      1      1288     11.348  0.001
MALE         43.90    47.98 #   8904.17 3765707.97      1      2139      5.058  0.025
FEMALE       45.79    51.81 #  17560.19 3418579.90      1      1941      9.970  0.002
NORTH        37.99    37.16 #    245.24 2402739.22      1      1446      0.148  0.701
SOUTH        48.76    56.32 #  37636.30 4571087.33      1      2634     21.687  0.000
PUBLIC       47.66    47.87 #     37.98 5931258.43      1      3305      0.021  0.884
SEPARATE     32.28    57.56 # 124219.84 1187585.05      1       775     83.165  0.000
```

FIGURE 95

expanded notation.

Rounding whole numbers, also a place-value skill, was also poorly handled. Although there was a significant increase in the proportion of students working to the 85-100 percent level in 1979, only one student in five was able to achieve this level. Forty-five percent of the grade four sample had achievement scores under 50 percent.

Sixty-five percent of the pupils could identify, read and write a fraction to represent a region to 100 perent accuracy. Another twenty-six percent could correctly answer one of two such items. They did rather poorly, however, when it came to identifying and generating equivalent fractions. Although significantly more pupils could do so in 1979, only twenty-eight percent achieved in category D (85-100 percent) on the equivalent fraction concept. Over half of the students had scores below 50 percent. Sub-group means for fractions ranged from 31 percent for the North Zone to 52 percent for the Separate Schools.

The two objectives involving the interpreting, expressing and generating of ratios also had relatively low performances. Only one pupil in three could reach the 85-100 percent level. About one pupil in two could provide the missing numeral in proportional ratios for at least three of the five examples.

OPERATIONS AND PROPERTIES (Ten Objectives, Figures 96 to 105)

Hypothesis 1

None of the objectives had performances whereby eighty percent of the Zone One pupils in 1978 and 1979 were within the 85-100 percent level.

Hypothesis 2

Three objectives had significant increases in the proportion of pupils achieving at the 85-100 percent level in 1979 over 1978.

Findings

Four test items, two addition and two subtraction, were used to determine the achievement of these algorithms. Only one pupil in four answered the rather cumbersome problems with 100 percent accuracy. The same proportion was able to solve one or none of the problems. Pupils actually added and subtracted decimals to hundredths with greater facility (Figure 104). About sixty percent of the pupils performed in categories C and D for decimals as compared with about fifty percent for the algorithms without decimals.

About one-half of the grade four pupils in both years were not able to write related sentences for addition, subtraction, multiplication and division. Only one in five performed in category D.

Fifty percent of the pupils in 1979 could not estimate products and quotient problems (Figure 98). This is about eight percent fewer than in 1978. Only one pupil in five reached the 85-100 percent level for multiplying whole numbers by one and two digit numbers. Fifty-seven percent of the pupils could, however, correctly answer three or more problems out of five. The remaining forty-three percent of the pupils could do one or fewer of the multiplication questions correctly.

About four pupils in ten could mentally multiply whole numbers by 10, 100 and 1000 to the 85-100 percent level. A similar proportion had mean scores below the 25 percent figure.

Two thirds of the pupils in grade four showed good understanding of the associative property of addition and subtraction. Less than fifteen percent of the Zone group had no understanding of this concept.

Performance for dividing one and two digit whole numbers by one-digit divisors was below that for the other operations. Forty-three percent of the pupils in 1979 failed to demonstrate any knowledge of division. Only one in four of the grade four children achieved within the 85-100 percent category.

About one-third of the students in 1978 and 1979 mastered (85-100 percent) the basic facts for sums and minuends to 18 and products and dividends through 81. The items measuring these skills involved both time and accuracy. Over one-third of the students performed at or below the 64 percent level with these two factors involved.

Test scores on problem solving and estimating answers were very low. Results were very similar for the two years with over fifty percent of the students failing on the

LEVEL D (Grade 4)

OPERATIONS AND PROPERTIES

OBJECTIVE 1 *Adds and subracts numbers using standard or expanded notations.*

TEST ITEMS

15. Solve each problem as shown:

```
   SUBTRACT         ADD      SUBTRACT         ADD

                    871
                    623
                    489                      7 764
     98 752         376        35 007        6 752
   - 75 176       + 554      -  3 879      + 8 568
   ________      ______      ________      _______

   ________      ______      ________      _______
```

ANALYSIS

```
   _ZONE_ONE__PUPILS_IN_1978_AND_1979_ACHIEVING_WITHIN_EACH_CATAGORY_A-D_
       CRITERION CATEGORIES FOR     GRADE:4    STRAND:2    OBJECTIVE: 1
            TOTAL NUMBER OF PUPILS:   1978 N=2115     1979 N=1969

          A: BELOW 50%         B:  50-64%          C:  65-84%          D: 85-100%
       ____1978____1979_____1978____1979_____1978____1979_____1978____1979_
NUMBER(%)  26.43    23.77     21.51    22.96     27.80    28.03     24.26    25.24
MEAN (%)   14.07    14.53     50.03    50.03     75.00    75.00    100.00   100.00

            TABLES COMPARING 1978 AND 1979 MEAN SCORES AND PROPORTIONS
   ___PROPORTION TEST___ #  ____________________F-TEST______________________
   HO: PROPOR78=PROPOR79 #  ________SS________  ______DF______
   _T-CALC____DF____PROB_#__BETWEEN_____WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
A:    1.959  4082   0.050 #     54.99  158889.45     1      1025     0.355   0.552
B:   -1.108  4082   0.268 #      0.00     311.81     1       905     0.000   0.996
C:   -0.166  4082   0.868 #  <<<<<<<<<<<<<< SSW IS EQUAL TO ZERO >>>>>>>>>>>>>>
D:   -0.730  4082   0.466 #  <<<<<<<<<<<<<< SSW IS EQUAL TO ZERO >>>>>>>>>>>>>>

   ______COMPARING_THE_MEAN_SCORES_OF_PUPILS_WITHIN_ZONE_SUBGROUPS_______
                            ____________________F-TEST TABLE__________________
GROUPS         YEARS       #  ________SS________  ______DF______
======_____1978____1979__#__BETWEEN_____WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
EARLY        58.25    59.74 #   1488.10 2935534.80     1      2710     1.374   0.241
LATE         62.36    64.49 #   1461.64 1230547.08     1      1288     1.530   0.216
MALE         57.43    57.86 #     97.34 2328759.21     1      2139     0.089   0.765
FEMALE       61.89    65.01 #   4722.98 1901467.68     1      1941     4.821   0.028
NORTH        54.63    55.27 #    150.25 1680448.74     1      1446     0.129   0.719
SOUTH        62.45    64.28 #   2208.67 2519308.31     1      2634     2.309   0.129
PUBLIC       61.44    61.13 #     82.09 3394454.69     1      3305     0.080   0.777
SEPARATE     51.41    61.53 #  19900.44  839174.83     1       775    18.379   0.000
```

FIGURE 96

OPERATIONS AND PROPERTIES

LEVEL D (Grade 4)

OBJECTIVE 2 *Writes related sentences for addition, subtraction, multiplication and division.*

TEST ITEMS

16. Write a related sentence for each number sentence below:

A. 5 + n = 11 ____________________

B. 14 - n = 6 ____________________

C. 9 X n = 36 ____________________

D. 48 ÷ n = 6 ____________________

17. Find the sentence that does not give the same answer for n as the other three. Write it in the blank.

A. 63 ÷ 7 = n   C. 63 ÷ n = 7

B. 63 = 7 X n   D. n ÷ 7 = 63   ____________

ANALYSIS

```
 _ZONE_ONE__PUPILS_IN_1978_AND_1979_ACHIEVING_WITHIN_EACH_CATAGCRY_A-D_
     CRITERION CATEGCRIES FOR     GRADE:4   STRAND:2   CEJECTIVE: 2
          TOTAL NUMBER OF PUPILS:  1978 N=2115    1979 N=1969

           A: BELOW 50%       B:  50-64%        C:  65-84%        D: 85-100%
        ____1978____1979_____1978____1979_____1978____1979_____1978____1979_
NUMBER(%)  50.45    46.17     23.50    26.46     5.67     4.47     20.38    22.91
MEAN (%)    8.89     9.10     50.96    50.86    75.00    75.00     97.22    97.17

            TABLES COMPARING 1978 AND 1979 MEAN SCORES AND PROPCRTIONS
   ___PROPCRTION TEST___ #  ____________________F-TEST_____________________
   HO: PROPOR78=PROPOR79 #  ________SS________  ______DF______
   _T-CALC____DF____PROB_#__BETWEEN_____WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
A:    2.737   4082    0.006 #     21.99  341402.53      1       1974     0.127  0.721
B:   -2.186   4082    0.029 #      2.15   10719.85      1       1016     0.204  0.652
C:    1.749   4082    0.081 # <<<<<<<<<<<<<< SSW IS EQUAL TO ZERC >>>>>>>>>>>>>>
D:   -1.961   4082    0.050 #      0.40   23991.94      1        880     0.015  0.503


   _____COMPARING_THE_MEAN_SCORES_OF_PUPILS_WITHIN_ZONE_SUBGROUPS______
                                ____________________F-TEST TABLE_________________
GROUPS          YEARS       #   ________SS________  ______DF______
======_____1978____1979__#__BETWEEN_____WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
EARLY          39.18    40.54 #   1263.74 3600976.31     1       2710     0.951  0.330
LATE           42.84    49.28 #  13401.48 1766632.92     1       1288     9.771  0.002
MALE           38.09    40.84 #   4031.34 2758237.02     1       2139     3.126  0.077
FEMALE         43.13    46.04 #   4104.22 2730996.46     1       1941     2.917  0.088
NORTH          35.05    33.02 #   1476.50 1912638.56     1       1446     1.116  0.291
SOUTH          43.69    48.59 #  15803.92 2459144.63     1       2634    12.034  0.001
PUBLIC         41.53    44.54 #   7448.87 4638153.54     1       3305     5.425  0.020
SEPARATE       36.09    38.08 #    768.87  985345.19     1        775     0.624  0.430
```

FIGURE 97

LEVEL D (Grade 4)

OPERATIONS AND PROPERTIES

OBJECTIVE 3 *Estimates products and quotients.*

TEST ITEMS

18. Write what you think should go in each blank space:

A. To estimate and solve 7 X 68, we can find the product
of 7 X ________ to equal 490.

B. To estimate and solve 53 X 47, we can find the product
of ________ X 50 to equal ________.

C. To estimate and solve 99 ÷ 21, we can find the quotient
of ________ ÷ ________ to equal ________.

D. To estimate and solve 397 ÷ 103, we can find the quotient
of ________ ÷ ________ to equal ________.

ANALYSIS

```
 _ZONE_ONE__PUPILS_IN_1978_AND_1979_ACHIEVING_WITHIN_EACH_CATAGORY_A-D_
     CRITERION CATEGORIES FOR     GRADE:4    STRAND:2    OBJECTIVE: 3
           TOTAL NUMBER OF PUPILS:  1978 N=2115    1979 N=1969

            A: BELOW 50%       B:  50-64%        C:  65-84%        D: 85-100%
         ____1978____1979_____1978____1979_____1978____1979_____1978____1979_
NUMBER(%)   60.66    52.67     4.30     4.37    16.03    19.76    19.01    23.21
MEAN (%)     8.12     8.26    55.56    55.56    72.73    72.12    94.91    94.97

            TABLES COMPARING 1978 AND 1979 MEAN SCORES AND PROPORTIONS
   ___PROPORTION TEST___ #  ___________________F-TEST______________________
   HO: PROPOR78=PROPOR79 #  ________SS________  ______DF______
   _T-CALC____DF____PROB_#__BETWEEN_____WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
A:    5.154   4082   0.000 #     10.87  384444.16     1       2318    0.066  0.798
B:   -0.102   4082   0.919 #     0.0         0.00     1        175    0.0    1.000
C:   -3.110   4082   0.002 #     66.96   22377.75     1        726    2.172  0.141
D:   -3.293   4082   0.001 #      0.60   26298.72     1        857    0.019  0.889

    ______COMPARING_THE_MEAN_SCORES_OF_PUPILS_WITHIN_ZONE_SUBGROUPS_______
                            ____________________F-TEST TABLE__________________
GROUPS          YEARS      #  ________SS________  ______DF______
======_____1978____1979__#__BETWEEN_____WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
EARLY       26.41    41.13 #  15077.41 4096111.23     1       2710    9.975  0.002
LATE        38.44    47.32 #  25410.54 1919972.65     1       1288   17.046  0.000
MALE        36.63    41.83 #  14459.42 3289721.16     1       2139    9.402  0.002
FEMALE      37.43    44.48 #  24068.10 2850977.87     1       1941   16.386  0.000
NORTH       28.59    32.11 #   4472.69 2026357.32     1       1446    3.192  0.074
SOUTH       41.89    48.76 #  31060.71 3908516.42     1       2634   20.932  0.000
PUBLIC      38.57    44.25 #  26636.37 5049266.00     1       3305   17.435  0.000
SEPARATE    30.18    38.23 #  12580.48 1061557.78     1        775    9.184  0.003
```

FIGURE 98

LEVEL D (Grade 4)

OPERATIONS AND PROPERTIES

OBJECTIVE 4 *Multiplies whole numbers by one and two digit whole numbers.*

TEST ITEMS

19. Find the products and write them in the blanks. Show all of your work for these problems on this page.

A. 54 X 4 = __________

B. 32 X 44 = __________

C. 821 X 95 = __________

D. 306 X 62 = __________

E. 4 X 763 = __________

ANALYSIS

```
  _ZONE_ONE:_PUPILS_IN_1978_AND_1979_ACHIEVING_WITHIN_EACH_CATAGORY_A-D_
      CRITERION CATEGORIES FOR     GRADE:4    STRAND:2    OBJECTIVE: 4
            TOTAL NUMBER OF PUPILS:  1978 N=2115    1979 N=1969

           A: BELOW 50%        B:  50-64%          C:  65-84%          D: 85-100%
       ____1978____1979_____1978____1979_____1978____1979_____1978____1979_
NUMBER(%)  46.10    42.97     14.99    17.27     21.37    19.30     17.54    20.47
MEAN (%)   18.43    18.92     60.00    59.97     79.98    79.95     99.97    99.88

            TABLES COMPARING 1978 AND 1979 MEAN SCORES AND PROPORTIONS
   ___PROPORTION TEST___  #  ____________________F-TEST_____________________________
   HO: PROPOR78=PROPOR79  #  ________SS________  ______DF______
   _T-CALC____DF____PROB_#__BETWEEN_____WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
A:    2.013   4082   0.044 #     110.35  513020.24      1       1819     0.391  0.532
B:   -1.981   4082   0.048 #       0.14      99.71      1        655     0.932  0.335
C:    1.643   4082   0.101 #       0.19     298.73      1        830     0.534  0.465
D:   -2.384   4082   0.017 #       1.82     593.53      1        772     2.370  0.124


    ______COMPARING_THE_MEAN_SCORES_OF_PUPILS_WITHIN_ZONE_SUBGROUPS_______
                             ____________________F-TEST TABLE___________________
GROUPS        YEARS       #  ________SS________  ______DF______
======_____1978____1979__#__BETWEEN_____WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
EARLY       50.78    53.07 #   3529.92 3408966.50      1       2710     2.806  0.094
LATE        55.28    57.04 #   1003.34 1483302.48      1       1288     0.871  0.351
MALE        49.97    51.43 #   1138.48 2589552.23      1       2139     0.940  0.332
FEMALE      54.41    57.69 #   5193.93 2378171.69      1       1941     4.239  0.040
NORTH       44.99    44.61 #     54.03 1835295.62      1       1446     0.043  0.837
SOUTH       56.24    59.42 #   6672.65 3002709.55      1       2634     5.853  0.016
PUBLIC      54.52    54.54 #      0.11 3987543.71      1       3305     0.000  0.993
SEPARATE    41.51    53.63 #  28523.60  955532.00      1        775    23.135  0.000
```

FIGURE 99

LEVEL D (Grade 4)

OPERATIONS AND PROPERTIES

OBJECTIVE 5 *Divides one and two-digit whole numbers by a one-digit divisor (with and without remainders).*

TEST ITEMS

20. Divide each problem and show remainders. Put your answers in the blanks. Show all of your work for these problems on this page.

A. 98 ÷ 9 = ________ remainder ________

B. 35 ÷ 7 = ________ remainder ________

C. 62 ÷ 8 = ________ remainder ________

D. 9 ÷ 4 = ________ remainder ________

E. 76 ÷ 6 = ________ remainder ________

ANALYSIS

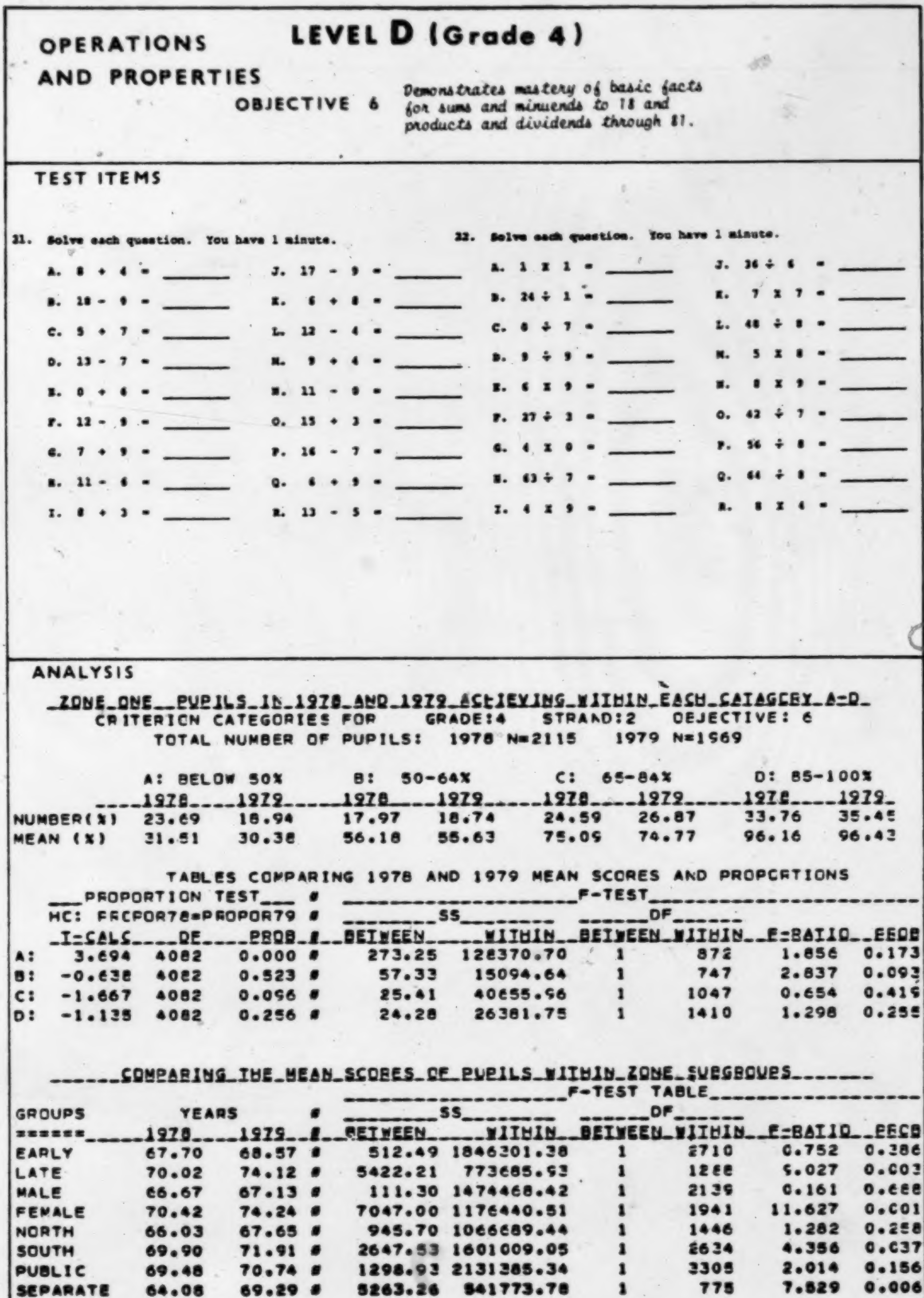
```
_ZONE_ONE__PUPILS_IN_1978_AND_1979_ACHIEVING_WITHIN_EACH_CATAGORY_A-D_
     CRITERION CATEGORIES FOR     GRADE:4    STRAND:2    OBJECTIVE: 5
          TOTAL NUMBER OF PUPILS:  1978 N=2115    1979 N=1969

            A: BELOW 50%        B:  50-64%        C:  65-84%       D: 85-100%
        ____1978____1979_____1978____1979_____1978____1979_____1978____1979_
NUMBER(%)   44.44   43.07     11.68   12.19     16.60   19.25    27.28   25.50
MEAN (%)    12.96   13.82     59.88   59.79     79.83   79.76    99.72   99.82

          TABLES COMPARING 1978 AND 1979 MEAN SCORES AND PROPORTIONS
                              #  _____________________F-TEST______________________
  ___PROPORTION TEST___       #  _________SS__________   ______DF______
  HO: PROPOR78=PROPOR79       #
  _T-CALC____DF____PROB_      #__BETWEEN______WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
A:   0.886   4082   0.376     #    332.27   490799.05      1     1786     1.209   0.272
B:  -0.503   4082   0.615     #      0.92      785.94      1      485     0.567   0.452
C:  -2.211   4082   0.027     #      0.81     1468.37      1      728     0.400   0.527
D:   1.294   4082   0.196     #      2.58     2439.50      1     1077     1.139   0.286

     ______COMPARING_THE_MEAN_SCORES_OF_PUPILS_WITHIN_ZONE_SUBGROUPS_______
                                 ____________________F-TEST TABLE________________
GROUPS         YEARS          #  _________SS__________   ______DF______
======_______1978____1979___#__BETWEEN______WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
EARLY        50.58    51.72   #    874.42  4194640.29      1     2710     0.565   0.452
LATE         58.66    58.65   #      0.04  1847579.88      1     1288     0.000   0.996
MALE         51.77    52.66   #    429.93  3270564.46      1     2139     0.281   0.596
FEMALE       54.75    55.61   #    364.87  2929562.25      1     1941     0.242   0.623
NORTH        43.59    44.22   #    144.24  2265043.32      1     1446     0.092   0.762
SOUTH        58.77    59.14   #     92.58  3732217.59      1     2634     0.065   0.798
PUBLIC       55.71    53.22   #   5099.88  4920405.83      1     3305     3.405   0.065
SEPARATE     42.17    57.41   #  45087.02  1194861.50      1      775    29.244   0.000
```

FIGURE 100



OPERATIONS
AND PROPERTIES

LEVEL D (Grade 4)

OBJECTIVE 6 *Demonstrates mastery of basic facts for sums and minuends to 18 and products and dividends through 81.*

TEST ITEMS

31. Solve each question. You have 1 minute.

A. 8 + 4 = ______
B. 18 - 9 = ______
C. 5 + 7 = ______
D. 13 - 7 = ______
E. 0 + 6 = ______
F. 12 - 9 = ______
G. 7 + 9 = ______
H. 11 - 6 = ______
I. 8 + 3 = ______
J. 17 - 9 = ______
K. 6 + 8 = ______
L. 12 - 4 = ______
M. 9 + 4 = ______
N. 11 - 8 = ______
O. 15 + 3 = ______
P. 16 - 7 = ______
Q. 6 + 9 = ______
R. 13 - 5 = ______

32. Solve each question. You have 1 minute.

A. 1 X 1 = ______
B. 24 ÷ 1 = ______
C. 0 ÷ 7 = ______
D. 9 ÷ 9 = ______
E. 6 X 9 = ______
F. 27 ÷ 3 = ______
G. 4 X 0 = ______
H. 63 ÷ 7 = ______
I. 4 X 9 = ______
J. 36 ÷ 6 = ______
K. 7 X 7 = ______
L. 48 ÷ 8 = ______
M. 5 X 8 = ______
N. 8 X 9 = ______
O. 42 ÷ 7 = ______
P. 56 ÷ 8 = ______
Q. 64 ÷ 8 = ______
R. 8 X 4 = ______

ANALYSIS

```
_ZONE_ONE__PUPILS_IN_1978_AND_1979_ACHIEVING_WITHIN_EACH_CATAGORY_A-D_
     CRITERICN CATEGORIES FOR      GRADE:4    STRAND:2    OEJECTIVE: 6
          TOTAL NUMBER OF PUPILS:   1978 N=2115     1979 N=1969

           A: BELOW 50%       B:  50-64%        C:  65-84%         D: 85-100%
       ____1978____1979_____1978____1979_____1978____1979______1978____1979_
NUMBER(%)  23.69     18.94     17.97    18.74     24.59    26.87      33.76    35.45
MEAN (%)   31.51     30.38     56.18    55.63     75.09    74.77      96.16    96.43

           TABLES COMPARING 1978 AND 1979 MEAN SCORES AND PROPORTIONS
   ___PROPORTION TEST___ #  ____________________F-TEST____________________
   HC: FRCPOR78=PROPOR79 #  ________SS________  ______DF______
   _T-CALC____DF____PROB_#__BETWEEN_____WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
A:    3.694  4082   0.000 #    273.25  128370.70     1       872    1.856  0.173
B:   -0.638  4082   0.523 #     57.33   15094.64     1       747    2.837  0.093
C:   -1.667  4082   0.096 #     25.41   40655.96     1      1047    0.654  0.419
D:   -1.135  4082   0.256 #     24.28   26381.75     1      1410    1.298  0.255


  ______COMPARING_THE_MEAN_SCORES_OF_PUPILS_WITHIN_ZONE_SUBGROUPS______
                            ____________________F-TEST TABLE________________
GROUPS        YEARS      #  ________SS________  ______DF______
======_____1978____1979__#__BETWEEN_____WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
EARLY       67.70    68.57 #    512.49 1846301.38     1      2710    0.752  0.386
LATE        70.02    74.12 #   5422.21  773685.93     1      1288    9.027  0.003
MALE        66.67    67.13 #    111.30 1474468.42     1      2139    0.161  0.688
FEMALE      70.42    74.24 #   7047.00 1176440.51     1      1941   11.627  0.001
NORTH       66.03    67.65 #    945.70 1066689.44     1      1446    1.282  0.258
SOUTH       69.90    71.91 #   2647.53 1601009.05     1      2634    4.356  0.037
PUBLIC      69.48    70.74 #   1298.93 2131385.34     1      3305    2.014  0.156
SEPARATE    64.08    69.29 #   5263.26  841773.78     1       775    7.829  0.006
```

FIGURE 101

LEVEL D (Grade 4)

OPERATIONS AND PROPERTIES

OBJECTIVE 7 *Solves word problems. Estimates answers.*

TEST ITEMS

23. Some estimates for the answer to each question are given. Write the closest estimate in the blank.

   A. 3 680 pigs. 52 in each pen.
   About how many pens?

   About 700? 70? 60? 600? ________

   B. 78 jelly beans in each jar. 6 jars.
   About how many jelly beans?

   About 300? 420? 480? 500? ________

   C. 28 students in Susan's class. Each drank about 5 glasses of water. About how many drinks did Susan's class take from the fountain in one day?

   About 150? 43? 300? 450? ________

24. Solve the problems in the space below. Write your answer in the blank.

   A. Bill weighs 64 kilograms. Sam weighs 51 kilograms. How much weight must Sam gain to weigh as much as Bill does?

   ____

   B. Mr. Jones travelled 1 530 kilometres in 17 hours. How many kilometres per hour did he travel?

   ____

   C. Susan's class held a noon hour sandwich sale. They sold 113 peanut butter, 80 ham, and 74 jam sandwiches. How many sandwiches did they sell in the sale?

   ____

ANALYSIS

```
 _ZONE_ONE__PUPILS_IN_1978_AND_1979_ACHIEVING_WITHIN_EACH_CATAGORY_A-D_
      CRITERION CATEGORIES FOR     GRADE:4    STRAND:2    OBJECTIVE: 7
           TOTAL NUMBER OF PUPILS:   1978 N=2115    1979 N=1969

           A: BELOW 50%       B:  50-64%        C:  65-84%         D: 85-100%
       ____1978____1979_____1978____1979_____1978____1979_____1978____1979_
NUMBER(%)  56.78    57.14     19.95    19.60     19.29    19.81      3.97     3.45
MEAN (%)   21.46    22.52     53.89    53.71     73.33    73.25     96.33    97.55

           TABLES COMPARING 1978 AND 1979 MEAN SCORES AND PROPORTIONS
    ___PROPORTION TEST___ #  ____________________F-TEST_______________________
    HO: PROPOR78=PROPOR79 #  _________SS________  ______DF______
    _T-CALC____DF____PROB_#__BETWEEN_____WITHIN__BETWEEN_WITHIN__F-RATIO__FPROB
A:   -0.226   4082   0.821 #    649.28  507269.09     1      2324     2.975  0.085
B:    0.280   4082   0.780 #      6.31   13916.18     1       806     0.365  0.546
C:   -0.416   4082   0.678 #      1.19   35880.46     1       756     0.024  0.877
D:    0.874   4082   0.382 #     55.90    2418.06     1       150     3.468  0.065

    ______COMPARING_THE_MEAN_SCORES_OF_PUPILS_WITHIN_ZONE_SUBGROUPS_______
                             ___________________F-TEST TABLE__________________
GROUPS           YEARS     #  _________SS________  ______DF______
======______1978____1979__#__BETWEEN_____WITHIN__BETWEEN_WITHIN__F-RATIO__FPROB
EARLY        39.19    39.57 #     97.73 1869294.25     1      2710     0.142  0.707
LATE         44.07    44.80 #    170.85  884157.80     1      1288     0.249  0.618
MALE         40.61    39.86 #    303.26 1464194.97     1      2139     0.443  0.506
FEMALE       41.23    42.88 #   1323.30 1376225.73     1      1941     1.866  0.172
NORTH        37.26    35.82 #    742.65 1085421.22     1      1446     0.989  0.320
SOUTH        43.02    44.10 #    770.24 1712965.29     1      2634     1.184  0.277
PUBLIC       41.58    41.74 #     19.94 2333521.20     1      2305     0.028  0.867
SEPARATE     37.96    39.38 #    391.68  805656.87     1       775     0.600  0.439
```

FIGURE 102

LEVEL D (Grade 4)

**OPERATIONS
AND PROPERTIES**

OBJECTIVE 8 *Mentally multiplies whole numbers by 10, 100, and 1 000.*

TEST ITEMS

35. Circle the correct answer to each multiplication problem.

A. 10 X 36 020 = (a) 36 020 (c) 360 200
(b) 3 602 (d) 3 600 200

B. 100 X 4 189 = (a) 41 890 (c) 004 189
(b) 418 900 (d) 4 189 000.

C. 1000 X 2 090 = (a) 2 090 (c) 000 290
(b) 200 900 (d) 2 090 000.

D. 216 X 10 = (a) 2 016 (c) 2 160
(b) 21 600 (d) 21 610

ANALYSIS

```
 _ZONE_ONE__PUPILS_IN_1978_AND_1979_ACHIEVING_WITHIN_EACH_CATAGCRY_A-D_
     CRITERION CATEGCRIES FOR     GRADE:4   STRAND:2   CEJECTIVE: 8
            TOTAL NUMBER OF PUPILS:  1978 N=2115    1979 N=1969

           A: BELOW 50%      B:  50-64%         C:  65-84%         D: 85-100%
        ____1978____1979_____1978____1979_____1978____1979_____1978____1979_
NUMBER(%)  40.09    39.97     20.80    21.18     16.36    17.57     22.74    21.28
MEAN (%)   12.26    11.63     50.06    50.06     75.00    75.00    100.00   100.00

            TABLES CCMPARING 1978 AND 1979 MEAN SCCRES AND PROPORTIONS
   ___PROPORTION TEST___ #  ______________________F-TEST______________________
   HO: PRCPOR78=PROPCR79 #  _________SS_________  ______DF______
   _T-CALC____DF____PROB_#__BETWEEN_____WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
A:   0.081   4082   0.935 #   166.00  258883.50     1     1633     1.047  0.306
B:  -0.294   4082   0.769 #     0.00     622.08     1      855     0.003  0.957
C:  -1.033   4082   0.302 #  <<<<<<<<<<<<<< SSW IS EQUAL TC ZERO >>>>>>>>>>>>>>
D:   1.127   4082   0.260 #  <<<<<<<<<<<<<< SSW IS EQUAL TC ZERO >>>>>>>>>>>>>>

   ______CCMPARING_THE_MEAN_SCORES_OF_PUPILS_WITHIN_ZONE_SUBGROUPS_______
                           ____________________F-TEST TABLE__________________
GROUPS        YEARS      #  _________SS_________  ______DF______
======_____1978____1979__#__BETWEEN_____WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
EARLY       48.25   47.53 #    352.10 3540793.68     1      2710     0.269  0.604
LATE        54.89   53.77 #    403.16 1622738.92     1      1288     0.320  0.572
MALE        48.75   48.31 #    106.96 2760138.98     1      2139     0.083  0.773
FEMALE      52.04   51.30 #    265.01 2537766.38     1      1941     0.203  0.653
NORTH       47.29   41.68 #  11341.52 1905524.85     1      1446     8.606  0.003
SOUTH       52.11   53.88 #   2061.92 3325185.80     1      2634     1.633  0.202
PUBLIC      51.15   49.80 #   1488.46 4350332.02     1      3305     1.131  0.288
SEPARATE    46.80   49.32 #   1230.46  951606.57     1       775     1.002  0.317
```

FIGURE 103

LEVEL D (Grade 4)

AND PROPERTIES
OPERATIONS **OBJECTIVE 9** *Adds and subtracts decimals to hundredths.*

TEST ITEMS

26. Solve each decimal problem.

A. 0.9 - 0.4 = ________
B. 4.3 - 0.8 = ________
C. 0.51 - 0.33 = ________
D. 0.91 - 0.28 = ________

27. Add:

```
A.  2.4     B.  1.3     C.  7.7     D.  7.29     E.  7.14
  + 3.6       + 4.8       + 6.7       + 5.80       + 6.95
  -----       -----       -----       ------       ------

  -----       -----       -----       ------       ------
```

ANALYSIS

```
_ZONE_ONE__PUPILS_IN_1978_AND_1979_ACHIEVING_WITHIN_EACH_CATAGORY_A-D_
     CRITERION CATEGORIES FOR     GRADE:4   STRAND:2   OBJECTIVE: 9
          TOTAL NUMBER OF PUPILS:  1978 N=2115    1979 N=1569

           A: BELOW 50%        B:  50-64%        C:  65-84%         D: 85-100%
        ----1978----1979-----1978----1979-----1978----1979-----1978----1979_
NUMBER(%)  34.42    26.71    10.26    12.29    21.13    24.38    34.18    36.62
MEAN (%)   16.10    17.13    55.56    55.56    71.86    72.11    95.42    95.65

          TABLES COMPARING 1978 AND 1979 MEAN SCORES AND PROPORTIONS
   ___PROPORTION TEST___ #  -------------------F-TEST_____________________
   HO: PROPOR78=PROPOR79 #  ________SS________  ______DF______
   _T-CALC____DF____PROB_#__BETWEEN_____WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
A:    5.335   4082   0.000 #   323.61  391938.19     1     1252    1.034  0.310
B:   -2.053   4082   0.040 #     0.0        0.00     1      457    0.0    1.000
C:   -2.472   4082   0.014 #    13.86   28546.61     1      925    0.449  0.503
D:   -1.625   4082   0.104 #    19.74   42824.21     1     1442    0.665  0.415

   ------COMPARING_THE_MEAN_SCORES_OF_PUPILS_WITHIN_ZONE_SUBGROUPS_______
GROUPS        YEARS         #  -------------------F-TEST TABLE_________________
======_____1978____1979__#__________SS__________  ______DF______
                            BETWEEN_____WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
EARLY        56.99    61.18 #  11833.58 3285344.35     1     2710     9.761  0.002
LATE         63.23    69.61 #  13104.84 1348301.61     1     1288    12.519  0.000
MALE         56.38    58.81 #   3242.83 2553518.69     1     2139     2.716  0.100
FEMALE       61.94    69.92 #  30900.36 2134653.73     1     1941    28.097  0.000
NORTH        53.63    57.55 #   5531.75 1833836.56     1     1446     4.362  0.037
SOUTH        62.18    67.36 #  17680.00 2852903.56     1     2634    16.323  0.000
PUBLIC       59.96    64.67 #  18247.84 3817816.17     1     3305    15.797  0.000
SEPARATE     55.02    61.31 #   7702.07  936104.91     1      775     6.377  0.012
```

FIGURE 104

OPERATIONS AND PROPERTIES

LEVEL D (Grade 4)

OBJECTIVE 10 *Understands the basis of associative property of addition and multiplication.*

TEST ITEMS

28. Complete each exercise: (Fill in the blanks).

$$a \times (b \times 2) = (a \times \_\_) \times 2$$

$$(x + y) + z = x + (y + \_\_)$$

☆ × (☾ × ☼) = (___ × ☾) × ☼

$$(m + n) + r = (\_\_ + m) + n$$

ANALYSIS

```
 _ZONE_ONE__PUPILS_IN_1978_AND_1979_ACHIEVING_WITHIN_EACH_CATAGORY_A-D_
      CRITERION CATEGORIES FOR    GRADE:4   STRAND:2   OBJECTIVE:10
              TOTAL NUMBER OF PUPILS:  1978 N=2115    1979 N=1969

            A: BELOW 50%      B:  50-64%        C:  65-84%        D: 85-100%
        ____1978____1979____1978____1979_____1978____1979_____1978____1979_
NUMBER(%)  13.95   14.27     5.53    4.72    14.37   13.36    66.15   67.65
MEAN (%)    6.36    6.67    50.11   50.27    75.00   75.00    99.94   99.99

            TABLES COMPARING 1978 AND 1979 MEAN SCORES AND PROPORTIONS
   ___PROPORTION TEST___ #  ____________________F-TEST_______________________
   HO: PROPOR78=PROPOR79 #  _________SS_________  ______DF______
   _T-CALC____DF____PROB_#__BETWEEN_____WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
A:   -0.297  4082   0.767 #    14.43    70884.01    1      574    0.117  0.733
B:    1.169  4082   0.243 #     1.36      460.69    1      208    0.614  0.434
C:    0.939  4082   0.348 #  <<<<<<<<<<<<<< SSW IS EQUAL TO ZERO >>>>>>>>>>>>>>
D:   -1.019  4082   0.308 #     1.93     1244.41    1     2729    4.229  0.040


    ______COMPARING_THE_MEAN_SCORES_OF_PUPILS_WITHIN_ZONE_SUBGROUPS_______
                            ____________________F-TEST TABLE__________________
GROUPS         YEARS      #  _________SS_________  ______DF______
======______1978____1979__#__BETWEEN_____WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
EARLY         79.03   80.23 #    978.83 3083158.28    1      2710    0.860   0.354
LATE          83.56   82.95 #    118.82 1268831.76    1      1288    0.121   0.728
MALE          78.48   78.95 #    118.85 2510610.07    1      2139    0.101   0.750
FEMALE        82.75   83.31 #    147.50 1940629.01    1      1941    0.148   0.701
NORTH         78.71   76.54 #   1693.15 1760079.01    1      1446    1.391   0.238
SOUTH         81.60   83.29 #   1882.26 2685819.28    1      2634    1.846   0.174
PUBLIC        80.34   80.69 #    105.10 3686937.72    1      3305    0.094   0.759
SEPARATE      81.46   82.19 #    103.89  782181.75    1       775    0.103   0.748
```

FIGURE 105

problem situations provided. Mean scores for all sub-groups ranged between 35 and 45 percent.

MEASUREMENT (Nine objectives; Figures 106 to 114)

Hypothesis 1

None of the objectives had performances where eighty percent of the Zone One pupils in 1978 and 1979 were in the 85-100 percent achievement category.

Hypothesis

Three objectives had significant increases in the proportion of students achieving at the 85-100 percent level in 1979 from 1978.

Findings

Even though the students performed significantly better on metric measurement items for the 1979 test session than in 1978, achievement was still low.

About thirty-six percent of the pupils in 1979 could estimate and measure using millimetres with 100 percent accuracy. An equal proportion of pupils could correctly respond to not more than one of the five items.

Over seventy percent of the grade four pupils could not express equivalent measures within units of capacity, mass, length and time (Figure 108). A similar proportion of students had difficulty with expressing linear measure to the nearest hundredth. Equivalent measures were used to test this understanding of decimals (Figure 114).

Forty-seven percent of students could read the Celsius thermometer with particular reference to freezing and boiling points of water, body and average room temperatures to 75 or 100 percent levels of accuracy.

Most pupils were aware of which standardized measuring units to use for various linear, capacity, and mass situations. About sixty percent of the students were at levels C and D (65-100 percent).

Although students improved their performance on reading and writing time to minutes from 1978 to 1979, still only one student in four could handle the five clock items with 100 percent accuracy. About half of the pupils could read only two or fewer of the clocks.

Significantly more grade four pupils could find the perimeter of regular polygons without using the formulae in 1979 than in 1978. Still over one-third of the pupils could not do so. Forty-six percent of the pupils could calculate the perimeter for three of the four problems.

One-third of the students could not find the area of regular figures by counting squares. The remaining two-thirds were, however, able to do solve for two of the three area problems.

Grade four pupils had difficulty with the four problem situations that required the use of money (coins and bills) for purchasing articles and making change. Two-thirds of the pupils could solve no more than two such problems and most of these one or none. The remaining one-third of the pupils correctly answered three or four of the money items.

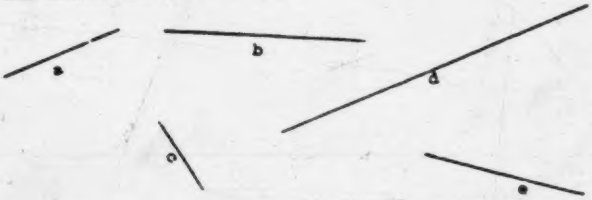
LEVEL D (Grade 4)

MEASUREMENT

OBJECTIVE 1 *Extends estimation and measurement to include the use of the standard units, mm, ml, and g .*

TEST ITEMS

1. Estimate the length of each line segment in millimetres and circle the best answer.



a. 10, 30, 50

b. 50, 35, 70

c. 10, 20, 30

d. 60, 80, 110

e. 20, 40, 60

ANALYSIS

```
  ZONE ONE  PUPILS IN 1978 AND 1979 ACHIEVING WITHIN EACH CATAGORY A-D
     CRITERION CATEGORIES FOR    GRADE:4   STRAND:3   OBJECTIVE: 1
           TOTAL NUMBER OF PUPILS:  1978 N=2115    1979 N=1969

             A: BELOW 50%       B:  50-64%         C:  65-84%         D: 85-100%
          ____1978____1979_____1978____1979_____1978____1979_____1978____1979_
NUMBER(%)   40.52    36.36     13.90    11.88     13.62    14.78     31.96    36.97
MEAN (%)    20.14    20.50     60.00    60.00     80.00    80.00    100.00   100.00

             TABLES COMPARING 1978 AND 1979 MEAN SCORES AND PROPORTIONS
   ___PROPORTION TEST___ #  ____________________F-TEST______________________
   HO: PROPOR78=PROPOR79 #  _________SS_________  ______DF______
   _T-CALC____DF____PROB_#__BETWEEN_____WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
A:    2.727  4082    0.006 #     51.34  439002.19     1     1571     0.184  0.668
B:    1.919  4082    0.055 #  <<<<<<<<<<<<<< SSW IS EQUAL TO ZERO >>>>>>>>>>>>>>
C:   -1.064  4082    0.288 #  <<<<<<<<<<<<<< SSW IS EQUAL TO ZERO >>>>>>>>>>>>>>
D:   -3.369  4082    0.001 #  <<<<<<<<<<<<<< SSW IS EQUAL TO ZERO >>>>>>>>>>>>>>

     ______COMPARING THE MEAN SCORES OF PUPILS WITHIN ZONE SUBGROUPS_______
                            ____________________F-TEST TABLE__________________
GROUPS          YEARS       #  _________SS_________  ______DF______
======_____1978____1979__#__BETWEEN_____WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
EARLY        58.48    62.51 #  11016.20 3643784.98      1       2710     8.193  0.004
LATE         60.90    66.16 #   8924.03 1602156.90      1       1288     7.174  0.008
MALE         60.70    62.82 #   2425.24 2761511.24      1       2139     1.879  0.171
FEMALE       57.93    64.02 #  17977.11 2605938.07      1       1941    13.390  0.000
NORTH        61.08    60.12 #    335.43 2001480.04      1       1446     0.242  0.623
SOUTH        58.36    65.08 #  29741.81 3356180.34      1       2634    23.342  0.000
PUBLIC       58.42    64.12 #  26779.25 4322454.26      1       3305    20.476  0.000
SEPARATE     63.48    60.36 #   1885.46 1037218.79      1        775     1.409  0.236
```

FIGURE 19C

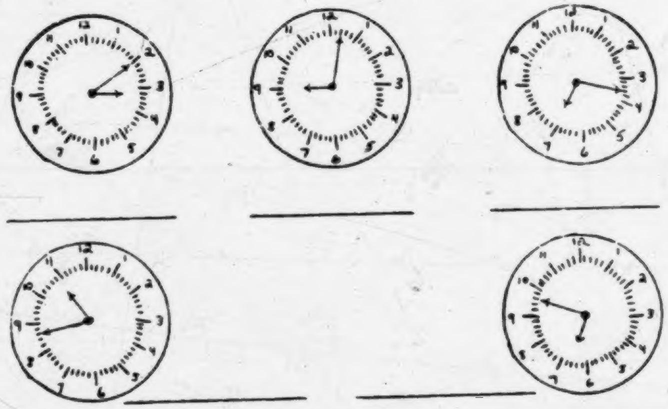
LEVEL D (Grade 4)

MEASUREMENT

OBJECTIVE 2 *Reads and writes time to minutes.*

TEST ITEMS

2. Write the time to the nearest minute for each clock.



ANALYSIS

```
_ZONE_ONE__PUPILS_IN_1978_AND_1979_ACHIEVING_WITHIN_EACH_CATAGORY_A-D_
     CRITERION CATEGORIES FOR    GRADE:4   STRAND:3   OBJECTIVE: 2
          TOTAL NUMBER OF PUPILS:  1978 N=2115    1979 N=1969

          A: BELOW 50%       B:  50-64%        C:  65-84%        D: 85-100%
       ____1978____1979_____1978____1979_____1978____1979_____1978____1979_
NUMBER(%)  50.21    45.71     15.08   13.10     13.95   15.19     20.76   26.00
MEAN (%)   13.92    14.96     60.00   60.00     80.00   80.00    100.00  100.00

           TABLES COMPARING 1978 AND 1979 MEAN SCORES AND PROPORTIONS
   ___PROPORTION TEST___ #  ___________________F-TEST_____________________
   HO: PROPOR78=PROPOR79 #  _________SS________  ______DF______
   _T-CALC____DF____PROB_#__BETWEEN_____WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
A:    2.879  4082   0.004 #    525.31  519402.93    1      1960     1.982  0.159
B:    1.815  4082   0.070 #  <<<<<<<<<<<<< SSW IS EQUAL TO ZERO >>>>>>>>>>>>>>
C:   -1.121  4082   0.263 #  <<<<<<<<<<<<< SSW IS EQUAL TO ZERO >>>>>>>>>>>>>>
D:   -3.964  4082   0.000 #  <<<<<<<<<<<<< SSW IS EQUAL TO ZERO >>>>>>>>>>>>>>


   ______COMPARING_THE_MEAN_SCORES_OF_PUPILS_WITHIN_ZONE_SUBGROUPS_______
                            ___________________F-TEST TABLE__________________
GROUPS          YEARS      #  _________SS________  ______DF______
======_____1978____1979__#__BETWEEN_____WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
EARLY       47.14    51.73 #  14199.28 3998097.48    1      2710     9.625  0.002
LATE        49.41    55.79 #  13125.23 1843123.14    1      1288     9.172  0.003
MALE        49.94    54.69 #  12115.50 3216597.81    1      2139     8.057  0.005
FEMALE      45.83    50.75 #  11714.49 2719226.11    1      1941     8.362  0.004
NORTH       42.48    44.93 #   2172.22 2106065.35    1      1446     1.491  0.222
SOUTH       51.12    56.96 #  22472.97 3745542.81    1      2634    15.804  0.000
PUBLIC      48.54    52.90 #  15696.79 4782507.50    1      3305    10.847  0.001
SEPARATE    45.37    52.64 #  10270.89 1166625.89    1       775     6.823  0.009
```

FIGURE 107

LEVEL D (Grade 4)

MEASUREMENT

OBJECTIVE 3

Expresses equivalent measures within units of capacity, mass, length and time. (e.g. 1 dm = 10 cm).

TEST ITEMS

3. Fill in the blanks to make the following measures equal.

A. _______ dm = 55 cm

B. _______ m = 6 km

C. _______ dm = 7 m

D. 150 cm = _______ m

E. 6 hours = _______ minutes

F. 13 cm = _______ mm

G. 600 secs. = _______ minutes

H. 9 ℓ = _______ mℓ

I. 6 kg = _______ g

ANALYSIS

```
                 PUPILS IN 1978 AND 1979 ACHIEVING WITHIN EACH CATAGORY A-D
 _ZONE_ONE__PUPILS_IN_1978_AND_1979_ACHIEVING_WITHIN_EACH_CATAGORY_A-D_
      CRITERION CATEGORIES FOR     GRADE:4    STRAND:3   OBJECTIVE: 3
             TOTAL NUMBER OF PUPILS:  1978 N=2115     1979 N=1969

                                                                  D: 85-100%
          A: BELOW 50%       B:  50-64%          C:  65-84%
       ____1978____1979_____1978____1979_____1978____1979_____1978____1979_
NUMBER(%)  78.35     71.86     5.86     7.47     9.50    12.04     6.29     8.63
MEAN (%)   13.63     15.05    55.56    55.56    72.28    72.01    93.15    92.61

          TABLES COMPARING 1978 AND 1979 MEAN SCORES AND PROPORTIONS
                                # ____________________F-TEST______________________
    ___PROPORTION TEST___       # ________SS________   ______DF______
    HO: PROPOR78=PROPOR79       # ________SS________   ______DF______
    _T=CALC____DF____PROB_#__BETWEEN_____WITHIN__BETWEEN_WITHIN__F=RATIO__PROB
A:    4.794   4082   0.000 #    1540.29   709454.92     1      3070    6.665  0.010
B:   -2.056   4082   0.040 #       0.0         0.00     1       269    0.0    1.000
C:   -2.614   4082   0.009 #       7.71    13599.95     1       436    0.247  0.619
D:   -2.858   4082   0.004 #      21.37     8559.49     1       301    0.752  0.387

              COMPARING THE MEAN SCORES OF PUPILS WITHIN ZONE SUBGROUPS______
     _____COMPARING_THE_MEAN_SCORES_OF_PUPILS_WITHIN_ZONE_SUBGROUPS_______
                               ___________________F-TEST TABLE________________
                               # ________SS________   ______DF______
GROUPS          YEARS          # ________SS________   ______DF______
======_____1978____1979__#__BETWEEN_____WITHIN__BETWEEN_WITHIN__F=RATIO__PROB
EARLY       24.79    29.66 #  16069.80  2317004.87     1      2710   18.795  0.000
LATE        30.49    35.12 #   6930.05  1194133.60     1      1288    7.475  0.006
MALE        28.74    32.83 #   8933.18  1962449.38     1      2139    9.737  0.002
FEMALE      24.44    30.26 #  16425.44  1638852.33     1      1941   19.454  0.000
NORTH       22.61    24.30 #   1032.61  1157094.99     1      1446    1.290  0.256
SOUTH       29.01    35.43 #  27193.75  2382219.45     1      2634   30.068  0.000
PUBLIC      27.37    32.81 #  24407.52  2999858.98     1      3305   26.890  0.000
SEPARATE    23.56    26.80 #   2040.68   598624.14     1       775    2.642  0.105
```

FIGURE 108

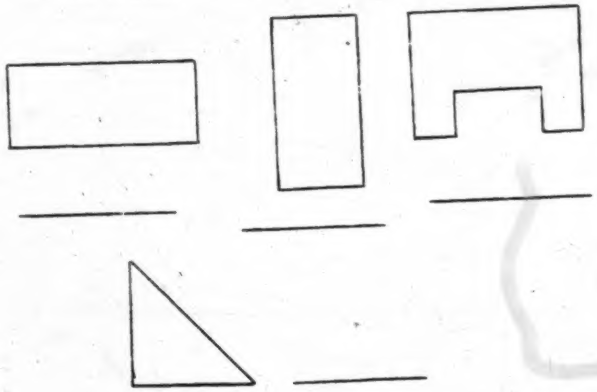
LEVEL D (Grade 4)

MEASUREMENT

OBJECTIVE 4 *Finds perimeters of regular polygons without using formulae.*

TEST ITEMS

4. Use your centimetre ruler to find the perimeter of each of the figures below in centimetres. Write you answer on the lines below.



ANALYSIS

```
 _ZONE_ONE__PUPILS_IN_1978_AND_1979_ACHIEVING_WITHIN_EACH_CATAGCBY_A-D_
     CRITERION CATEGCRIES FOR     GRADE:4    STRAND:3    GEJECTIVE: 4
           TOTAL NUMBER OF PUPILS:  1978 N=2115    1979 N=1969

             A: BELOW 50%       B:  50-64%          C:  65-84%          D: 85-100%
                                          1978____1979______1978_____1979_
         ____1978____1979____1978_____1979____1978    21.53      20.09     24.23
NUMBER(%)  46.10     36.26     15.41    17.98    18.39    75.00      98.47     98.72
MEAN (%)    6.58      8.46     53.53    52.47    75.00

           TABLES COMPARING 1978 AND 1979 MEAN SCORES AND PROPORTIONS
                                 ____________________F-TEST_____________________
   ___PROPCRTION TEST___ #  _________SS_________  ______DF______
   HC: PRCPOR78=PROPOR79 #  BETWEEN_____WITHIN__BETWEEN_WITHIN__F-RATIO__PRCB
   _T-CALC____DF____PRCB_#__                1        1687      8.920  0.003
A:    6.379   4082   0.000 #   1455.15  275210.59     1         678      6.719  0.010
B:   -2.199   4082   0.028 #    189.20   19092.97   
C:   -2.812   4082   0.012 #  <<<<<<<<<<<<<< SSW IS EQUAL TO ZERO >>>>>>>>>>>>>>
D:   -3.180   4082   0.002 #     13.53   14000.64     1         900      0.870  0.351


        ______COMPARING_THE_MEAN_SCORES_OF_PUPILS_WITHIN_ZONE_SUBGROUPS_______
                                  ____________________F-TEST TABLE_________________
GROUPS           YEARS       #  _________SS_________  ______DF______
======_____1978____1979__#__BETWEEN_____WITHIN__BETWEEN_WITHIN__F-RATIO__PRCB
EARLY        43.43     51.57 #  44785.16 3998372.51     1       2710     30.354   0.000
LATE         47.69     54.74 #  16031.27 1833608.27     1       1288     11.261   0.001
MALE         46.15     52.45 #  21229.33 3123436.57     1       2139     14.538   0.000
FEMALE       43.49     52.70 #  41071.61 2827979.79     1       1941     28.190   0.000
NORTH        39.38     50.61 #  45653.86 2159893.34     1       1446     30.564   0.000
SOUTH        48.09     53.58 #  20132.23 3754249.65     1       2634     14.125   0.000
PUBLIC       46.09     51.66 #  25569.26 4836035.29     1       3305     17.474   0.000
SEPARATE     39.48     56.28 #  55033.37 1098434.50     1        775     38.829   0.000
```

FIGURE 109

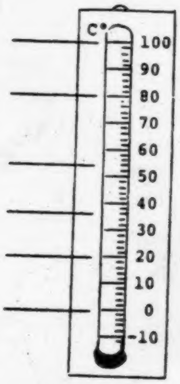
LEVEL D (Grade 4)

MEASUREMENT

OBJECTIVE 5 *Reads Celsius thermometer (familiarity with freezing and boiling points of water, body and environmental temperatures).*

TEST ITEMS

5. Place the letter of each item below next to its Celsius temperature on the thermometer. Use only four blanks.
   - A. Human Body Temperature
   - B. Water Freezes
   - C. Water Boils
   - D. Average Room Temperature



ANALYSIS

```
_ZONE_ONE__PUPILS_IN_1978_AND_1979_ACHIEVING_WITHIN_EACH_CATAGCRY_A-D_
      CRITERION CATEGCRIES FOR     GRADE:4   STRAND:3   CEJECTIVE: 5
           TCTAL NUMBER OF PUPILS:  1978 N=2115    1979 N=1969

           A: BELOW 50%       B:  50-64%        C:  65-84%       D: 85-100%
        ----1978----1979-----1978----1979-----1978----1979-----1978----1979_
NUMBER(%)  28.94    27.88     28.94   24.68     13.85   14.37     28.27   33.06
MEAN (%)    9.44     9.13     50.10   50.18     75.00   75.00     99.58  100.00

            TABLES CCMPARING 1978 AND 1979 MEAN SCCRES AND PROPORTIONS
   ___PROPORTION TEST___ #  ____________________F-TEST______________________
   HO: PRCPOR78=PROPOR79 #  ________SS________  ______DF______
   _T=CALC___DF____PROB_#__BETWEEN_____WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
A:    0.746  4082   0.456 #    27.10  171771.45     1      1159     0.183  0.669
B:    3.064  4082   0.002 #     1.64    1852.86     1      1096     0.973  0.324
C:   -0.476  4082   0.634 #  <<<<<<<<<<<<<< SSW IS EQUAL TO ZERO >>>>>>>>>>>>>>
D:   -3.318  4082   0.001 #     0.14     155.99     1      1247     1.089  0.297

   -----CCMPARING THE MEAN SCORES OF PUPILS WITHIN ZONE SUBGROUPS-------
                                 ____________________F-TEST TABLE__________________
GROUPS          YEARS        #  ________SS________  ______DF______
======_____1978_____1979__#__BETWEEN_____WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
EARLY       54.20    56.78 #  4499.94 3699258.35     1      2710     3.297  0.070
LATE        58.95    62.27 #  3554.33 1517933.68     1      1288     3.016  0.083
MALE        55.33    59.15 #  7803.08 2811402.60     1      2139     5.937  0.015
FEMALE      56.48    58.35 #  1684.11 2541793.60     1      1941     1.286  0.257
NORTH       48.27    50.06 #  1143.23 2067689.64     1      1446     0.799  0.371
SOUTH       60.29    63.30 #  5974.34 3137932.38     1      2634     5.015  0.025
PUBLIC      56.25    58.98 #  6142.40 4273334.75     1      3305     4.751  0.030
SEPARATE    54.28    57.93 #  2587.86 1079308.05     1       775     1.858  0.173
```

FIGURE 110

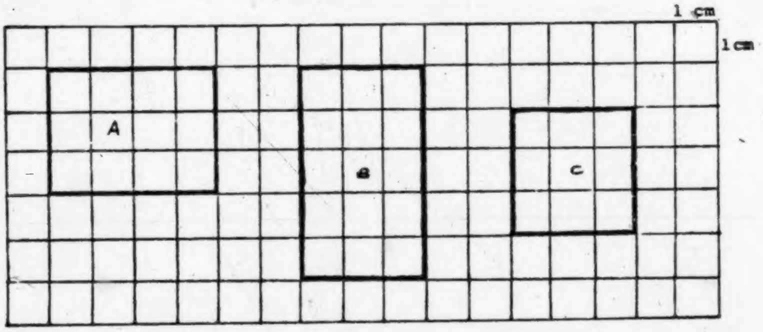
LEVEL D (Grade 4)

MEASUREMENT

OBJECTIVE 6 *Finds area of rectangles without using formulae.*

TEST ITEMS

6. Find the area of each rectangle below.



A. ____________ B. ____________ C. ____________

ANALYSIS

```
_ZONE_ONE__PUPILS_IN_1978_AND_1979_ACHIEVING_WITHIN_EACH_CATAGORY_A-D_
     CRITERION CATEGORIES FOR     GRADE:4   STRAND:3   OBJECTIVE: 6
          TOTAL NUMBER OF PUPILS:  1978 N=2115    1979 N=1969

             A: BELOW 50%       B:  50-64%        C:  65-84%        D: 85-100%
         ____1978____1979_____1978____1979_____1978____1979_____1978____1979_
NUMBER(%)  36.69    33.11      3.59     2.69     30.31    30.47    29.41    33.72
MEAN (%)    1.35     1.81     50.00    50.00     82.29    82.06   100.00   100.00

          TABLES COMPARING 1978 AND 1979 MEAN SCORES AND PROPORTIONS
   ___PROPORTION TEST___ #  ___________________F-TEST______________________
   HO: PROPOR78=PROPOR79 #  _________SS________  ______DF______
   _T-CALC____DF____PROB_#__BETWEEN_____WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
A:    2.395  4082   0.017 #     75.57   58098.25    1     1426     1.855  0.173
B:    1.646  4082   0.100 #  <<<<<<<<<<<<<< SSW IS EQUAL TO ZERO >>>>>>>>>>>>>>
C:   -0.115  4082   0.909 #     17.52   22215.90    1     1239     0.977  0.323
D:   -2.966  4082   0.003 #  <<<<<<<<<<<<<< SSW IS EQUAL TO ZERO >>>>>>>>>>>>>>


    ______COMPARING_THE_MEAN_SCORES_OF_PUPILS_WITHIN_ZONE_SUBGROUPS_______
                            ___________________F-TEST TABLE_________________
GROUPS        YEARS        #  _________SS________  ______DF______
======_____1978____1979__#__BETWEEN_____WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
EARLY       55.04    58.23 #   7288.45 5130619.51    1      2710     3.850  0.050
LATE        59.45    65.09 #  10282.99 2317046.89    1      1288     5.716  0.017
MALE        56.77    59.89 #   5213.05 3985687.10    1      2139     2.798  0.095
FEMALE      56.51    61.56 #  12387.02 3625800.21    1      1941     6.631  0.010
NORTH       56.41    54.85 #     87[illegible].66 2738981.24    1      1446     0.460  0.498
SOUTH       56.78    63.70 #  31524.47 4839212.76    1      2634    17.159  0.000
PUBLIC      58.86    60.71 #   2830.95 6123593.30    1      3305     1.528  0.217
SEPARATE    46.89    60.54 #  36174.19 1443647.92    1       775    19.421  0.000
```

FIGURE 111

LEVEL D (Grade 4)

MEASUREMENT

OBJECTIVE 7 *Uses appropriate standardized measuring units.*

TEST ITEMS

7. Circle the best answer.

A. The weight of a chocolate bar would be expressed in:

a. milligrams
b. grams
c. kilograms

B. Your body weight would be expressed in:

a. milligrams
b. grams
c. kilograms

C. The amount of water in a swimming pool will be expressed in.

a. millilitre
b. litres
c. kilolitres

D. The amount of milk in a glass of milk would be measured in:

a. millilitres
b. litres
c. kilolitres

8. A. Circle the type of unit you would most likely use to measure the distance around a swimming pool.

a. metres
b. centimetres
c. kilometres

B. The width of your desk would be expressed in:

a. kilometres
b. centimetres
c. millimetres

ANALYSIS

```
 _ZONE_ONE__PUPILS_IN_1978_AND_1979_ACHIEVING_WITHIN_EACH_CATAGCEY_A-D_
      CRITERION CATEGCRIES FOR      GRADE:4   STRAND:3   OBJECTIVE: 7
            TOTAL NUMBER OF PUPILS:  1978 N=2115    1979 N=1969

          A: BELOW 50%       B:  50-64%         C:  65-84%         D: 85-100%
      ____1978____1979_____1978____1979_____1978____1979_____1978____1979_
NUMBER(%)  24.30   20.82    20.24   17.12    41.61   44.49    13.85   17.57
MEAN (%)   22.60   22.72    50.00   50.00    74.09   74.71   100.00  100.00

             TABLES CCMPARING 1978 AND 1979 MEAN SCCRES AND PROPORTICNS
   ___PROPORTION TEST___ #  ____________________F-TEST_____________________
   HO: PRCPOR78=PROPOR79 #  _________SS________  ______DF______
   _T-CALC____DF____PRCB_#__BETWEEN_____WITHIN__BETWEEN_WITHIN__F-RATIC__PROB
A:   2.656  4082   0.008 #      3.45  168527.09    1       922    0.019  0.891
B:   2.554  4082   0.011 #  <<<<<<<<<<<<< SSW IS EQUAL TC ZERO >>>>>>>>>>>>>
C:  -1.859  4082   0.063 #    170.77  121145.82    1      1754    2.473  0.116
D:  -3.269  4082   0.001 #  <<<<<<<<<<<<< SSW IS EQUAL TO ZERO >>>>>>>>>>>>>


   ______COMPARING_THE_MEAN_SCORES_CF_PUPILS_WITHIN_ZONE_SUBGROUPS_______
                            ____________________F-TEST TABLE_________________
GROUPS         YEARS     #  _________SS________  ______DF______
======_____1978____1979__#__BETWEEN_____WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
EARLY       58.37   62.07 #   8288.64 2104772.65    1      2710   10.672  0.001
LATE        63.74   67.72 #   5114.22  832658.39    1      1288    7.911  0.005
MALE        62.60   64.90 #   2845.24 1611950.02    1      2139    3.776  0.052
FEMALE      57.83   63.19 #  13940.52 1382926.01    1      1941   19.566  0.000
NORTH       55.55   60.25 #   7971.17 1262065.66    1      1446    9.133  0.003
SOUTH       63.03   66.10 #   6193.10 1703576.76    1      2634    9.576  0.002
PUBLIC      61.91   64.51 #   5570.23 2361678.88    1      3305    7.795  0.005
SEPARATE    53.15   62.44 #  16731.15  620865.02    1       775   20.885  0.000
```

FIGURE 112

LEVEL D (Grade 4)

MEASUREMENT

OBJECTIVE 8 *Uses money (coins and bills) for purchasing and making change.*

TEST ITEMS

9. Solve the problems. Write your answers in the blanks.

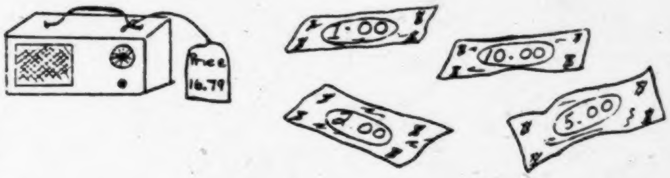
A. Bill gave the clerk $5.00 to pay for a set of magnets that costs $4.29. What amount of money will Bill receive as change?

____

B. Mrs. White gave the clerk a ten dollar bill to pay for a purse that cost $6.52. What amount of money will Mrs. White receive as change?

____

10. A. Joan wants to buy a radio.
Circle the bills she will need to buy it.



B. How much money will she get back?

____

ANALYSIS

```
 _ZONE_ONE__PUPILS_IN_1978_AND_1979_ACHIEVING_WITHIN_EACH_CATAGORY_A-D_
      CRITERION CATEGORIES FOR     GRADE:4   STRAND:3   OBJECTIVE: 8
          TOTAL NUMBER OF PUPILS:  1978 N=2115 . 1979 N=1969

            A: BELOW 50%     B:  50-64%       C:  65-84%        D: 85-100%
         ----1978----1979-----1978----1979------1978----1979------1978----1979_
NUMBER(%)  49.13    46.57    17.78    17.83     14.18    16.66     18.91    18.94
MEAN (%)   10.58    11.55    50.10    50.21     75.00    75.00     99.81    99.90

          TABLES COMPARING 1978 AND 1979 MEAN SCORES AND PROPORTIONS
   ___PROPORTION TEST___ #  _______________________F-TEST_____________________
   HO: PROPOR78=PROPOR79 #  _________SS________  ______DF______
   _T=CALC___DF___PROB_#__BETWEEN____WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
A:    1.632  4082   0.103 #   459.00 305315.22     1      1954     2.938  0.087
B:   -0.041  4082   0.968 #     2.36   1386.48     1       725     1.232  0.267
C:   -2.190  4082   0.029 # <<<<<<<<<<<<<< SSW IS EQUAL TO ZERO >>>>>>>>>>>>>>
D:   -0.028  4082   0.980 #     1.46   1388.42     1       771     0.811  0.368

   ------COMPARING_THE_MEAN_SCORES_OF_PUPILS_WITHIN_ZONE_SUBGROUPS_______
                            _____________________F-TEST TABLE____________________
GROUPS        YEARS      #  _________SS________  ______DF______
======_____1978____1979__#__BETWEEN____WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
EARLY       41.62   44.20 #  4501.87 3678262.18     1     2710     3.317  0.069
LATE        47.22   48.82 #   820.73 1658826.07     1     1288     0.637  0.425
MALE        43.52   45.22 #  1548.97 2809442.10     1     2139     1.179  0.278
FEMALE      43.73   46.35 #  3334.36 2660926.29     1     1941     2.432  0.119
NORTH       38.27   38.06 #    16.96 1940576.53     1     1446     0.013  0.911
SOUTH       46.71   49.74 #  6058.49 3435069.64     1     2634     4.646  0.031
PUBLIC      45.89   46.30 #   142.51 4440025.22     1     3305     0.106  0.745
SEPARATE    33.60   43.46 # 18879.35  980347.45     1      775    14.925  0.000
```

FIGURE 113

LEVEL D (Grade 4)

MEASUREMENT

OBJECTIVE 9 *Expresses linear measure to nearest hundredth.*

TEST ITEMS

11. Fill in the blanks using decimals.

A. __________ m = 25 cm

B. __________ cm = 0.80 m

C. __________ cm = 605 mm

D. 128 cm = __________ m

E. 0.05 mm = __________ dm

F. 240 mm = __________ cm

G. 325 cm = __________ m

H. 1 050 cm = __________ m

ANALYSIS

```
   _ZONE_ONE__PUPILS_IN_1978_AND_1979_ACHIEVING_WITHIN_EACH_CATAGORY_A-D_
       CRITERION CATEGORIES FOR     GRADE:4   STRAND:3   OBJECTIVE: 9
            TOTAL NUMBER OF PUPILS:  1978 N=2115    1979 N=1969

              A: BELOW 50%       B;  50-64%         C:  65-84%        D: 85-100%
          ____1978____1979_____1978____1979_____1978____1979_____1978____1979_
NUMBER(%)   88.42   77.60      6.95   13.66      2.13    4.72      2.51    4.01
MEAN (%)     5.80    8.99     55.10   55.02     75.00   75.00     90.05   93.99

            TABLES COMPARING 1978 AND 1979 MEAN SCORES AND PROPORTIONS
   ___PROPORTION TEST___  #  ____________________F-TEST____________________
   HO: PROPOR78=PROPOR79  #  ________SS________  ______DF______
   _T-CALC____DF____PROB_#__BETWEEN_____WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
A:   9.236  4082   0.000 #   8548.29  499945.90     1      3396   58.066  0.000
B:  -7.086  4082   0.000 #      0.66   15648.38     1       414    0.018  0.895
C:  -4.587  4082   0.000 #  <<<<<<<<<<<<<< SSW IS EQUAL TO ZERO >>>>>>>>>>>>>>>
D:  -2.720  4082   0.007 #    480.73    4443.52     1       130   14.064  0.000


   ______COMPARING_THE_MEAN_SCORES_OF_PUPILS_WITHIN_ZONE_SUBGROUPS_______
                             ____________________F-TEST TABLE__________________
GROUPS          YEARS     #  ________SS________  ______DF______
======______1978____1979__#__BETWEEN_____WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
EARLY        12.07   19.66 # 38942.86 1606679.31     1      2710   65.685  0.000
LATE         14.32   24.30 # 32113.79  838167.70     1      1288   49.349  0.000
MALE         13.01   21.47 # 38244.96 1349616.29     1      2139   60.614  0.000
FEMALE       12.60   22.19 # 44577.94 1237877.02     1      1941   69.899  0.000
NORTH         9.06   15.66 # 15657.15  683987.08     1      1446   33.100  0.000
SOUTH        14.98   25.00 # 66127.70 1847999.53     1      2634   94.253  0.000
PUBLIC       14.20   22.70 # 59701.48 2164647.65     1      3305   91.153  0.000
SEPARATE      6.71   18.13 # 25337.48  398871.41     1       775   49.230  0.000
```

FIGURE 114

GEOMETRY (Three items; Figures 115 to 117)

Hypothesis 1

None of the objectives had performances where eighty percent of the Zone One pupils in 1978 and 1979 were in the 85-100 percent category.

Hypothesis 2

Two objectives had significant increases in the proportion of pupils achieving at the 85-100 percent level in 1979 over 1978.

Findings

Three-quarters of the grade four students correctly identified congruent polygons from a set of mixed shapes. Performance was similar for the two years with sub-group means in the 70 to 78 percent range.

Student performance on identifying the axis of symmetry in a symmetric figure rose 14 percent for 1979 to where about one-half of the students could correctly draw all lines of symmetry on a rectangle.

Significant gains in the proportion of students who could identify translations (slides), reflections (flips), and rotations (turns) were made in the 1979 testing. Forty-six percent of the pupils could correctly perform at least three of the four transformations. The remaining fifty-four percent of the grade four pupils succeeded on two or fewer of the items.

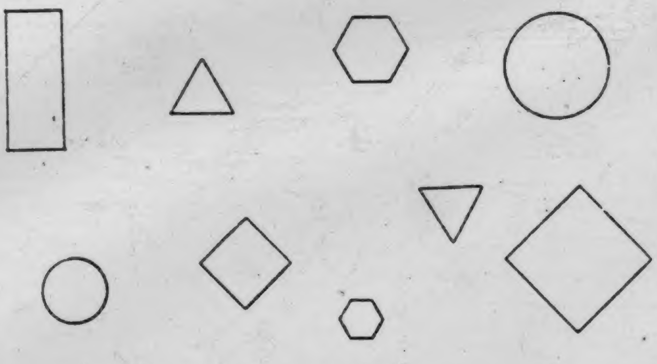
LEVEL D (Grade 4)

GEOMETRY

OBJECTIVE 1 *Recognizes congruency of polygons.*

TEST ITEMS

12. Circle the two simple figures that are congruent.



ANALYSIS

```
 _ZONE_ONE__PUPILS_IN_1978_AND_1979_ACHIEVING_WITHIN_EACH_CATAGCRY_A-D_
     CRITERICN CATEGCRIES FOR     GRADE:4   STRAND:4   OBJECTIVE: 1
          TOTAL NUMBER OF PUPILS:  1978 N=2115    1979 N=1969

        A: BELOW 50%       B:  50-64%         C:  65-84%         D: 85-100%
    ____1978____1979_____1978____1979_____1978____1979_____1978____1979_
NUMBER(%)  26.19    24.48     0.05    0.10      0.14    0.05    73.62   75.37
MEAN (%)    0.10     0.80    50.00   50.00     71.43   71.43   100.00   99.98

            TABLES CCMPARING 1978 AND 1979 MEAN SCCRES AND PROPORTIONS
   ___PROPCRTION TEST___ #  ____________________F-TEST_____________________
   HO: PRCPOR78=PROPOR79 #  _________SS________  ______DF______
   _T-CALC____DF____PRCB_#__BETWEEN______WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
A:    1.258  4082   0.209 #    125.25   11011.97    1      1034   11.761  0.001
B:   -0.640  4082   0.522 #  <<<<<<<<<<<<<< SSW IS EGUAL TO ZERO >>>>>>>>>>>>>>
C:    0.930  4082   0.353 #  <<<<<<<<<<<<<< SSW IS EQUAL TC ZERO >>>>>>>>>>>>>>
D:   -1.282  4082   0.200 #      0.28     407.61    1      3039    2.100  0.148


    ______CCMPARING_THE_MEAN_SCORES_CF_PUPILS_WITHIN_ZONE_SUBGROUPS_______
                            ____________________F-TEST TABLE__________________
GROUPS        YEARS        #  _________SS_________  ______DF______
=======_____1978____1979__#__BETWEEN______WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
EARLY        72.71   73.69 #    657.17 5287016.58    1      2710    0.337   0.562
LATE         75.59   78.98 #   3712.09 2246506.07    1      1288    2.128   0.145
MALE         71.13   73.77 #   3743.58 4241895.31    1      2139    1.888   0.170
FEMALE       76.59   77.76 #    655.89 3404472.67    1      1941    0.374   0.541
NORTH        68.88   69.67 #    225.46 3072604.58    1      1446    0.106   0.745
SOUTH        76.60   78.74 #   3010.42 4531588.85    1      2634    1.750   0.186
PUBLIC       73.91   75.23 #   1451.41 6230747.33    1      3305    0.770   0.381
SEPARATE     73.16   77.29 #   3314.05 1437682.86    1       778    1.786   0.182
```

FIGURE 115

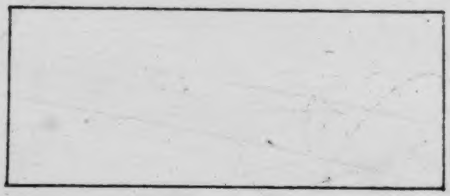
LEVEL D (Grade 4)

GEOMETRY

OBJECTIVE 2 *Identifies axis of symmetry in symmetric objects and figures.*

TEST ITEMS

13. Draw in all the axes of symmetry for the figure below.



ANALYSIS

```
  _ZCNE_ONE__PUPILS_IN_1978_AND_1979_ACHIEVING_WITHIN_EACH_CATAGCRY_A-D_
      CRITERION CATEGCRIES FOR     GRADE:4   STRAND:4   CEJECTIVE: 2
           TOTAL NUMBER OF PUPILS:  1978 N=2115    1979 N=1969

           A: BELOW 50%        B:  50-64%        C:  65-84%        D: 85-100%
       ____1978____1979_____1978____1979_____1978____1979_____1978____1979_
NUMBER(%)  46.57   27.07     17.78   13.81      0.76    0.20     34.89   48.91
MEAN (%)    0.16    0.58     50.03   50.00     74.69   75.00    100.00  100.00

            TABLES COMPARING 1978 AND 1979 MEAN SCORES AND PROPORTIONS
   ___PROPCRTION TEST___ #  ___________________F-TEST______________________
   HO: PRCPOR78=PROPOR79 #  ________SS________  ______DF______
   _T-CALC___DF___PROB_#__BETWEEN_____WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
A:   6.148  4082   0.000 #    71.48   13882.37    1      1713     8.820  0.003
B:   3.464  4082   0.001 #     0.11      99.73    1       646     0.723  0.395
C:   2.531  4082   0.011 #     0.31      73.44    1        18     0.077  0.785
D:  -9.078  4082   0.000 #  <<<<<<<<<<<<<< SSW IS EQUAL TO ZERO >>>>>>>>>>>>>>

   ______COMPARING_THE_MEAN_SCORES_OF_PUPILS_WITHIN_ZONE_SUBGROUPS_______
                             _________________F-TEST TABLE_________________
GROUPS          YEARS      #  ________SS________  ______DF______
======______1978____1979__#__BETWEEN______WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
EARLY        43.56   53.15 #   62151.00 5551466.81    1      2710    30.340  0.000
LATE         46.25   60.66 #   66946.79 2618064.14    1      1288    32.936  0.000
MALE         43.12   56.03 #   89179.10 4408648.32    1      2139    43.268  0.000
FEMALE       45.83   56.35 #   53663.67 3955118.36    1      1941    26.336  0.000
NORTH        42.39   45.97 #    4596.62 2842257.18    1      1446     2.339  0.126
SOUTH        45.60   61.49 #  166154.66 5413676.09    1      2634    80.842  0.000
PUBLIC       45.26   56.31 #  100818.35 6800399.50    1      3305    48.998  0.000
SEPARATE     40.78   55.63 #   43009.35 1860871.92    1       775    21.358  0.000
```

FIGURE 116

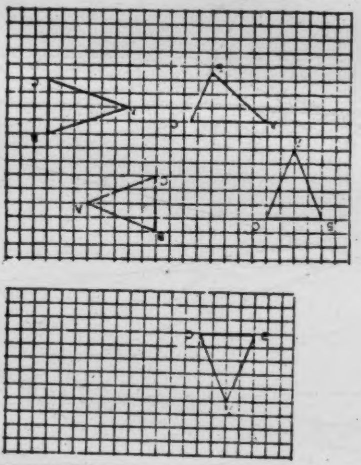
LEVEL D (Grade 4)

GEOMETRY

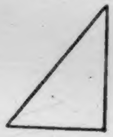
OBJECTIVE 3 *Identifies translations (slides), reflections (flips), and rotations (turns).*

TEST ITEMS

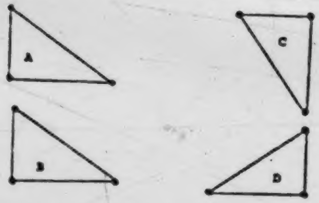
14. Look at the triangle below. On the grid paper with 4 triangles, circle the image which makes a 1/4 turn around A in a clockwise direction.



15. Draw a flip image to go with the figure given.



16. Circle the figure that is the slide image of figure A.



ANALYSIS

```
_ZONE_ONE__PUPILS_IN_1978_AND_1979_ACHIEVING_WITHIN_EACH_CATAGCRY_A-D_
     CRITERION CATEGORIES FOR    GRADE:4   STRAND:4   OEJECTIVE: 3
          TOTAL NUMBER OF PUPILS:  1978 N=2115   1979 N=1969

          A: BELOW 50%      B:  50-64%        C:  65-84%        D: 85-100%
      ----1978----1979-----1978----1979-----1978----1979-----1978----1979_
NUMBER(%)  42.46    36.72    16.88    17.62    17.83    16.56    22.84    29.10
MEAN (%)   20.86    21.17    57.18    57.18    71.45    71.45    99.91    99.89

         TABLES COMPARING 1978 AND 1979 MEAN SCORES AND PROPORTIONS
  ___PROPORTION TEST___ #  ____________________F-TEST______________________
  HC: FRCPOR78=PROPOR79 #  _________SS________  ______DF______
  _T-CALC____DF____PROB_#__BETWEEN_____WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
A:   3.746  4082   0.000 #    37.97  402472.01    1      1619    0.153  0.696
B:  -0.629  4082   0.530 #     0.00     611.09    1       702    0.000  0.987
C:   1.073  4082   0.283 #     0.00     101.75    1       701    0.011  0.918
D:  -4.569  4082   0.000 #     0.14    1366.54    1      1054    0.111  0.739

  ______COMPARING_THE_MEAN_SCORES_OF_PUPILS_WITHIN_ZONE_SUBGROUPS_______
                                ____________________F-TEST TABLE________________
GROUPS        YEARS       #  _________SS________  ______DF______
======_____1978____1979__#__BETWEEN_____WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
EARLY       52.46    56.95 #  13671.98 3102854.10    1      2710   11.941   0.001
LATE        57.03    61.89 #   7599.73 1361834.26    1      1288    7.188   0.007
MALE        53.55    57.74 #   9380.50 2371072.27    1      2139    8.462   0.004
FEMALE      54.61    59.90 #  13562.81 2197151.53    1      1941   11.981   0.001
NORTH       50.67    49.67 #    361.52 1802025.30    1      1446    0.290   0.590
SOUTH       56.02    63.46 #  36478.17 2670763.22    1      2634   35.976   0.000
PUBLIC      55.38    59.47 #  13799.18 3777348.57    1      3305   12.074   0.001
SEPARATE    48.25    55.79 #  11059.82  773348.16    1       775   11.083   0.001
```

IGURE 117

GRAPHING (Four objectives; Figures 118 to 121)

Hypothesis 1

None of the objectives had performances where eighty percent of the Zone One pupils in 1978 and 1979 were in the 85-100 percent achievement category.

Hypothesis 2

Three objectives had significantly increases in the proportions of pupils achieving at the 85-100 percent level in 1979 over 1978.

Findings

About seven in ten students in 1979 could recognize and read a bar, line and circle graph to the 85-100 percent level. Achievement means for all sub-groups in 1979 were from 76 percent for the North Zone students to 87 percent for late starters. These sub-groups are not mutually exclusive, however, so direct comparisons are not that meaningful.

Two-thirds of the students in the 1979 group could construct both the pictogaph and the bar graph with 98 percent accuracy.

Two-thirds of the students in the second year of testing could identify coordinates from ordered pairs in two of the three test items. About one-half of the students in 1979 received 100 percent scores for the objective. Close to fifty percent of the pupils in 1978 and 1979 could not generate ordered pairs from a given relationship, however about forty percent of the grade four's could do so with 100

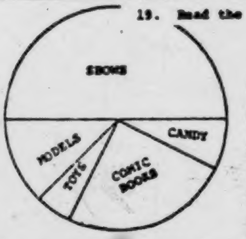
LEVEL D (Grade 4)

GRAPHING

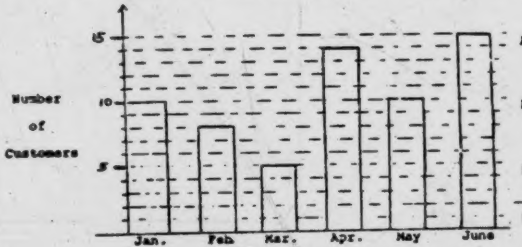
OBJECTIVE 1 *Recognizes and reads bar, line, circle and pictographs.*

TEST ITEMS

17. The circle graph shows how John spent his allowance last month. List in order the things he spent his money on. Start with the thing he spent most on, and finish with the thing he spent the least on.



18. This graph shows the number of customers Ed had each month for a half year on his paper route.



A. What month did Ed have the fewest customers? ______

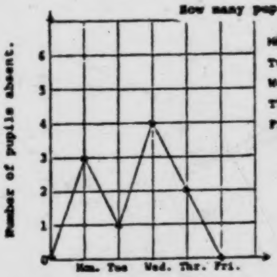
B. How many customers did he have during the month of fewest customers? ______

C. What month did Ed have the most customers? ______

D. How many customers did he have during the month he had the most customers? ______

19. Read the line graph below and answer the question that follows:

How many pupils were absent:



Monday ______
Tuesday ______
Wednesday ______
Thursday ______
Friday ______

ANALYSIS

```
_ZONE_ONE__PUPILS_IN_1978_AND_1979_ACHIEVING_WITHIN_EACH_CATAGCRY_A-D_
     CRITERION CATEGCRIES FOR     GRADE:4    STRAND:5    OBJECTIVE: 1
          TOTAL NUMBER OF PUPILS:  1978 N=2115    1979 N=1969

           A: BELOW 50%       B:  50-64%         C:  65-84%          D: 85-100%
       ____1978____1979_____1978____1979_____1978____1979_____1978____1979_
NUMBER(%)  11.49    11.38      5.58    4.22     17.83   15.08      65.11   69.32
MEAN (%)   23.10    22.17     57.18   57.35     72.48   72.01      98.37   98.30

           TABLES COMPARING 1978 AND 1979 MEAN SCORES AND PROPORTIONS
   ___PROPORTION TEST___ #  ____________________F-TEST______________________
   HO: PRCPOR78=PROPOR79 #  _________SS________  ______DF______
   _T-CALC____DF____PROB_#__BETWEEN_____WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
A:     0.113  4082   0.910 #    100.27  159096.11     1       465     0.293  0.589
B:     2.013  4082   0.044 #      1.48    2164.14     1       199     0.136  0.713
C:     2.358  4082   0.019 #     37.57   17385.25     1       672     1.452  0.229
D:    -2.868  4082   0.004 #      4.15   39545.85     1      2740     0.287  0.592


     ______COMPARING_THE_MEAN_SCORES_OF_PUPILS_WITHIN_ZONE_SUBGROUPS_______
                                  __________________F-TEST TABLE__________________
GROUPS          YEARS          #  ___ ___SS________  ______DF______
======_____1978____1979___#__BETWEEN_____WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
EARLY         80.98   82.11  #   8[illegible]0.12 2055222.44    1      2710     1.147  0.284
LATE          86.96   87.47  #    [illegible]5.57  638816.21    1      1288     0.173  0.678
MALE          82.98   83.56  #   17[illegible].65 1457464.45    1      2139     0.264  0.608
FEMALE        82.64   84.39  #  14[illegible].59 1314824.95    1      1941     2.193  0.139
NORTH         77.12   76.07  #   39[illegible].82 1375866.88    1      1446     0.418  0.518
SOUTH         86.10   88.03  #  245[illegible].30 1293727.79    1      2634     4.959  0.026
PUBLIC        84.02   83.24  #   50[illegible].07 2224011.46    1      3305     0.745  0.388
SEPARATE      77.49   86.84  # 169[illegible].76  531087.78    1       775    24.758  0.000
```

FIGURE 118

LEVEL D (Grade 4)

GRAPHING

OBJECTIVE 2 *Constructs line, bar and pictographs.*

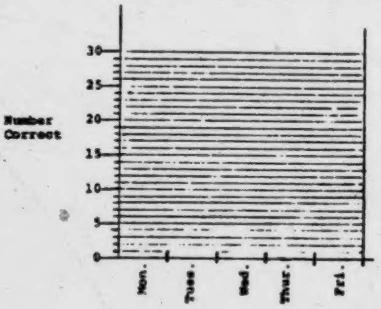
TEST ITEMS

20. In a field trip, Mary's class saw 5 birds, 6 mice, 7 spruce trees, and 2 snakes. Draw a pictograph to show this information.

WHAT WE SAW ON A FIELD TRIP

Birds									
Mice									
Spruce Trees									
Snakes									

21. Every day last week John had a math quiz. Here is how he scored. Draw a bar graph to show how well he did.



Monday - 15 right
Tuesday - 17 right
Wednesday - 25 right
Thursday - 12 right
Friday - 20 right

ANALYSIS

```
 _ZONE_ONE__PUPILS_IN_1978_AND_1979_ACHIEVING_WITHIN_EACH_CATAGCRY_A-D_
        CRITERION CATEGCRIES FOR    GRADE:4   STRAND:5   OEJECTIVE: 2
             TOTAL NUMBER OF PUPILS:  1978 N=2115    1979 N=1969

            A: BELOW 50%       B:  50-64%        C:  65-84%       D: 85-100%
        ----1978----1979-----1978----1979-----1978----1979-----1978----1979_
NUMBER(%)   27.23   20.01     9.08    6.04     6.19    7.47    57.49   66.48
MEAN (%)    23.51   24.31    55.64   55.70    74.30   73.56    97.95   98.38

             TABLES COMPARING 1978 AND 1979 MEAN SCORES AND PROPORTIONS
   ___PROPORTION TEST___ #  _____________________F-TEST______________________
   HC: PRCPOR78=PROPOR79 #  ________SS________  ______DF______
   _T=CALC____DF____PROB_#__BETWEEN_____WITHIN__BETWEEN_WITHIN__F=RATIO__PRCB
A:    5.421  4082   0.000 #    147.65  418001.00      1       968    0.342  0.559
B:    3.653  4082   0.000 #      0.21     428.32      1       309    0.150  0.699
C:   -1.613  4082   0.107 #     35.66    7094.30      1       276    1.387  0.240
D:   -5.907  4082   0.000 #    118.93   42571.45      1      2523    7.048  0.008

   -----,COMPARING_THE_MEAN_SCORES_OF_PUPILS_WITHIN_ZONE_SUBGROUPS_______
                               ___________________F-TEST TABLE______,_____________
GROUPS          YEARS       #  ________SS________  ______DF______
======_______1978____1979___#__BETWEEN_____WITHIN__BETWEEN_WITHIN__F=RATIO__PRCB
EARLY       71.04    76.91 #  23311.98 3132947.67      1      2710   20.165  0.000
LATE        74.76    82.88 #  21258.99 1205815.87      1      1288   22.708  0.000
MALE        69.77    77.26 #  29982.12 2459576.53      1      2139   26.074  0.000
FEMALE      75.15    81.26 #  1806 .91 1949205.14      1      1941   17.986  0.000
NORTH       68.75    75.07 #  14375.92 1791971.51      1      1446   11.600  0.001
SOUTH       74.47    81.24 #  3021 .00 2607070.20      1      2634   30.525  0.000
PUBLIC      73.57    78.07 #  1676 .16 3609372.81      1      2305   15.347  0.000
SEPARATE    67.11    83.46 #  51961.67  800226.31      1       778   50.324  0.000
```

FIGURE 119

LEVEL D (Grade 4)

GRAPHING

OBJECTIVE 3 *Writes co-ordinates as ordered pairs.*

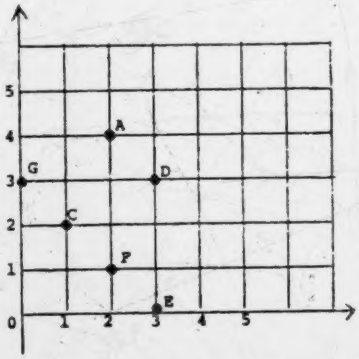
TEST ITEMS

22. Give the letters for each pair of co-ordinates from the graph to the right.

(1, 2) ________

(3, 3) ________

(3, 0) ________



ANALYSIS

```
 _ZONE_ONE__PUPILS_IN_1978_AND_1979_ACHIEVING_WITHIN_EACH_CATEGORY_A-D_
     CRITERION CATEGORIES FOR     GRADE:4   STRAND:5   OBJECTIVE: 3
          TOTAL NUMBER OF PUPILS:  1978 N=2115   1979 N=1969

           A: BELOW 50%       B:  50-64%        C:  65-84%        D: 85-100%
       ____1978____1979_____1978____1979_____1978____1979_____1978____1979_
NUMBER(%)  43.40    32.76     0.0      0.0      16.78    17.83    39.81    49.42
MEAN (%)   10.86    11.11   ******   ******     66.67    66.67   100.00   100.00

             TABLES COMPARING 1978 AND 1979 MEAN SCORES AND PROPORTIONS
   ___PROPORTION TEST___ #  ______________________F-TEST_______________________
   HO: PROPOR78=PROPOR79 #  _________SS_________  ______DF______
   _T-CALC____DF____PROB_#__BETWEEN______WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
A:   6.995   4082   0.000 #     24.47  383274.03     1      1561    0.100  0.752
B:   0.0     4082   1.000 #  <<<<<<<< TOO FEW PUPILS FOR CALCULATIONS >>>>>>>>
C:  -0.879   4082   0.379 #  <<<<<<<<<<<<< SSW IS EQUAL TO ZERO >>>>>>>>>>>>>>
D:  -6.173   4082   0.000 #  <<<<<<<<<<<<< SSW IS EQUAL TO ZERO >>>>>>>>>>>>>>

    ______COMPARING_THE_MEAN_SCORES_OF_PUPILS_WITHIN_ZONE_SUBGROUPS_______
                                 _____________________F-TEST TABLE_________________
GROUPS        YEARS        #  _________SS_________  ______DF______
======______1978_____1979__#__BETWEEN______WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
EARLY        53.62    62.03 #  47837.57 4742354.17     1      2710    27.337  0.000
LATE         60.04    70.59 #  35873.38 2068464.26     1      1288    22.338  0.000
MALE         54.13    63.45 #  46490.92 3721909.10     1      2139    26.719  0.000
FEMALE       57.40    66.63 #  41241.04 3257865.72     1      1941    24.571  0.000
NORTH        49.20    56.71 #  20299.99 2544752.43     1      1446    11.534  0.001
SOUTH        59.48    69.21 #  62440.68 4324564.88     1      2634    38.031  0.000
PUBLIC       57.60    63.07 #  24667.77 5679933.92     1      3305    14.354  0.000
SEPARATE     47.40    72.63 # 123600.06 1248929.61     1       775    76.698  0.000
```

GURE 120

LEVEL D (Grade 4)

GRAPHING

OBJECTIVE 4 *Generates ordered pairs from a given relationship.*

TEST ITEMS

23. Everytime a circus elephant was given 3 peanuts he would perform a trick. Make ordered pairs to show the ratio of peanuts to tricks for the following:

Example: (3, 1)

A. 12 peanuts ________

B. 15 peanuts ________

C. 9 peanuts ________

D. 27 peanuts ________

ANALYSIS

```
 _ZONE_ONE__PUPILS_IN_1978_AND_1979_ACHIEVING_WITHIN_EACH_CATAGCRY_A-D_
      CRITERION CATEGCRIES FOR    GRADE:4   STRAND:5   CBJECTIVE: 4
           TOTAL NUMBER OF PUPILS:  1978 N=2115    1979 N=1969

           A: BELOW 50%       B:  50-64%         C:  65-84%        D: 85-100%
        ____1978____1979_____1978____1979_____1978____1979_____1978____1979_
NUMBER(%)  51.73   47.28     3.69    2.89     5.96    8.23    38.63   41.59
MEAN (%)    1.30    1.26    50.00   50.00    75.00   75.00   100.00  100.00

          TABLES COMPARING 1978 AND 1979 MEAN SCORES AND PROPORTICNS
   ___PROPORTION TEST___  #  ____________________F-TEST______________________
   HO: FRCPOR78=PROPOR79  #  ________SS________  ______DF______
   _T-CALC____DF____PROB_#__BETWEEN_____WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
A:   2.838   4082   0.005 #     0.82   61660.90     1     2023    0.027   0.869
B:   1.417   4082   0.157 #  <<<<<<<<<<<<< SSW IS EQUAL TC ZERO >>>>>>>>>>>>>>
C:  -2.831   4082   0.005 #  <<<<<<<<<<<<< SSW IS EQUAL TC ZERO >>>>>>>>>>>>>>
D:  -1.933   4082   0.053 #  <<<<<<<<<<<<< SSW IS EQUAL TC ZERO >>>>>>>>>>>>>>


   _____COMPARING_THE_MEAN_SCORES_OF_PUPILS_WITHIN_ZONE_SUBGROUPS______
GROUPS          YEARS        #  ___________________F-TEST TABLE_________________
======_____1978____1979__#__BETWEEN_____WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
EARLY        44.25    46.90 #   4727.67 6014140.33     1      2710     2.130  0.145
LATE         48.99    54.22 #   8813.14 2873474.17     1      1288     3.950  0.047
MALE         45.11    49.45 #  10105.75 4742872.42     1      2139     4.558  0.033
FEMALE       46.16    50.22 #   7976.09 4353007.57     1      1941     3.557  0.060
NORTH        41.97    43.24 #    582.33 3194862.68     1      1446     0.264  0.608
SOUTH        47.72    53.22 #  19911.59 5841483.28     1      2634     8.978  0.003
PUBLIC       47.07    48.25 #   1141.75 7328467.79     1      3305     0.511  0.475
SEPARATE     39.19    56.22 #  56289.53 1668798.95     1       775    26.141  0.000
```

FIGURE 121

percent accuracy.

A. DISCUSSION OF THE GRADE FOUR RESULTS

The 1978 and 1979 mathematics achievement in grade four, determined by the zone one tests, is somewhat low. The evidence in Tables 14, 15 and 15 shows this to be the case for many individual objectives and also for the total strand.

How much of the poor performance can be attributed to the fact that the grade four program contains the largest number of objectives (35) is unclear. There are some new concepts introduced, however the primary emphasis is with objectives that represent extensions from the earlier grades.

Number

The five place value objectives involving such skills as identifying value of digits in numerals, regrouping, rounding, and reading and writing numerals, exemplify the extension principal. The low achievement trend in these topics was even more dramatic at the grade four level than in previous grades. If one considers that such skills as place value are to be part of the "minimum" essentials in the program and it is generally agreed that they are, something is wrong.

Although pupils do have difficulty with decimals to hundredths, the test results from questions three and four in Figure 88 indicate that decimals themselves may not be

TABLE 14
THE 1978 AND 1979 ZONE ONE MEAN SCORES FOR GRADE FOUR BY OBJECTIVES AND STRAND

ZONE ONE GRADE FOUR JUNE/78

NUMBER		OPERATIONS & PROPERTIES		MEASUREMENT		GEOMETRY		GRAPHING	
1	48.4%	1	59.6%	1	59.4%	1	73.8%	1	82.8%
2	43.7%	2	40.5%	2	48.0%	2	44.4%	2	72.4%
3	43.6%	3	37.0%	3	26.7%	3	54.1%	3	55.7%
4	76.6%	4	52.1%	4	44.9%			4	45.6%
5	37.7%	5	53.2%	5	55.9%				
6	56.7%	6	68.5%	6	56.6%				
7	49.2%	7	40.9%	7	60.3%				
8	9.6%	8	50.3%	8	43.6%				
9	44.8%	9	59.0%	9	12.8%				
		10	80.5%						
AVG	45.6%		54.2%		45.3%		57.4%		64.1%

ZONE ONE GRADE FOUR JUNE/79

NUMBER		OPERATIONS & PROPERTIES		MEASUREMENT		GEOMETRY		GRAPHING	
1	58.7%	1	61.2%	1	63.4%	1	75.6%	1	83.9%
2	53.8%	2	43.3%	2	52.8%	2	56.2%	2	79.1%
3	50.3%	3	43.1%	3	31.6%	3	58.7%	3	64.9%
4	79.8%	4	54.4%	4	52.6%			4	49.8%
5	45.6%	5	54.0%	5	58.8%				
6	60.2%	6	70.5%	6	60.7%				
7	57.9%	7	41.3%	7	64.1%				
8	16.2%	8	49.7%	8	46.7%				
9	49.8%	9	64.0%	9	21.8%				
		10	81.0%						
AVG	52.5%		56.2%		50.2%		63.5%		69.5%

the problem. There may be a general lack of understanding due to handling place value at the abstract level only. This could occur from the rote learning associated with teaching

TABLE 15

ACHIEVEMENT MEANS IN 1978 AND 1979 WITHIN CATEGORIES A-D FOR THE NUMBER, OPERATIONS AND PROPERTIES, AND MEASUREMENT STRANDS

```
 _ZONE_ONE__PUPILS_IN_1978_AND_1979_ACHIEVING_WITHIN_EACH_CATAGORY_A-D_
      CRITERION CATEGORIES FOR  GRADE:4  STRAND: NUMBER
           TOTAL NUMBER OF PUPILS:  1978 N=2115    1979 N=1969

           A: BELOW 50%      B:  50-64%       C:  65-84%        D: 85-100%
       ____1978____1979_____1978____1979_____1978____1979_____1978____1979_
NUMBER(%)  58.87   47.28     15.98   18.28    17.40   20.92      7.75   13.51
MEAN (%)   28.02   29.64     57.15   57.00    73.87   74.37     91.66   92.42

              TABLES COMPARING 1978 AND 1979 MEAN SCORES AND PROPORTIONS
    ___PROPORTION TEST___ #  _____________________F-TEST______________________
    HO: PROPOR78=PROPOR79 #  _________SS_________  ______DF______
    _T-CALC____DF____PROB_#__BETWEEN_____WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
A:    7.413  4082   0.000 #   1396.93  369697.13     1      2174    8.215   0.004
B:   -1.953  4082   0.051 #      3.95   11657.55     1       696    0.236   0.627
C:   -2.863  4082   0.004 #     47.94   26041.82     1       778    1.432   0.232
D:   -5.988  4082   0.000 #     58.05   10198.10     1       428    2.436   0.119


 _ZONE_ONE__PUPILS_IN_1978_AND_1979_ACHIEVING_WITHIN_EACH_CATAGORY_A-D_
      CRITERION CATEGORIES FOR  GRADE:4  STRAND: OPERATIONS & PROPERTIES
           TOTAL NUMBER OF PUPILS:  1978 N=2115    1979 N=1969

           A: BELOW 50%      B:  50-64%       C:  65-84%        D: 85-100%
       ____1978____1979_____1978____1979_____1978____1979_____1978____1979_
NUMBER(%)  42.79   38.09     20.95   21.94    25.53   28.29     10.73   11.68
MEAN (%)   31.56   32.05     57.36   57.01    74.35   74.12     90.16   90.34

              TABLES COMPARING 1978 AND 1979 MEAN SCORES AND PROPORTIONS
    ___PROPORTION TEST___ #  _____________________F-TEST______________________
    HO: PROPOR78=PROPOR79 #  _________SS_________  ______DF______
    _T-CALC____DF____PROB_#__BETWEEN_____WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
A:    3.057  4082   0.002 #    100.69  268548.61     1      1653    0.620   0.431
B:   -0.774  4082   0.439 #     26.34   14842.79     1       873    1.549   0.214
C:   -1.986  4082   0.047 #     15.24   36690.32     1      1095    0.455   0.500
D:   -0.960  4082   0.337 #      3.77    7690.42     1       455    0.223   0.637


 _ZONE_ONE__PUPILS_IN_1978_AND_1979_ACHIEVING_WITHIN_EACH_CATAGORY_A-D_
      CRITERION CATEGORIES FOR  GRADE:4  STRAND: MEASUREMENT
           TOTAL NUMBER OF PUPILS:  1978 N=2115    1979 N=1969

           A: BELOW 50%      B:  50-64%       C:  65-84%        D: 85-100%
       ____1978____1979_____1978____1979_____1978____1979_____1978____1979_
NUMBER(%)  59.05   49.87     20.38   22.04    16.97   22.45      3.59    5.64
MEAN (%)   30.62   31.90     56.91   57.02    73.44   73.92     88.95   90.42

              TABLES COMPARING 1978 AND 1979 MEAN SCORES AND PROPORTIONS
    ___PROPORTION TEST___ #  _____________________F-TEST______________________
    HO: PROPOR78=PROPOR79 #  _________SS_________  ______DF______
    _T-CALC____DF____PROB_#__BETWEEN_____WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
A:    5.889  4082   0.000 #    897.51  356056.98     1      2229    5.619   0.018
B:   -1.300  4082   0.194 #      3.03   15078.35     1       863    0.174   0.677
C:   -4.402  4082   0.000 #     44.96   27252.69     1       799    1.318   0.251
D:   -3.123  4082   0.002 #     97.26    2608.29     1       165    6.899   0.009
```

TABLE 16

ACHIEVEMENT MEANS IN 1978 AND 1979 WITHIN CATEGORIES
A-D FOR THE GEOMETRY AND GRAPHING STRANDS

```
 _ZONE_ONE__PUPILS_IN_1978_AND_1979_ACHIEVING_WITHIN_EACH_CATAGORY_A-D_
     CRITERION CATEGORIES FOR  GRADE:4  STRAND: GEOMETRY
            TOTAL NUMBER OF PUPILS:  1978 N=2115    1979 N=1969

          A: BELOW 50%      B:  50-64%        C:  65-84%        D: 85-100%
      ____1978____1979_____1978____1979_____1978____1979_____1978____1979_
NUMBER(%)  36.60    30.12     17.07    13.81     22.65    21.74     23.69    34.33
MEAN (%)   24.60    25.05     55.60    55.27     74.15    73.30     93.43    94.40

             TABLES COMPARING 1978 AND 1979 MEAN SCORES AND PROPORTIONS
   ___PROPORTION TEST___ #  ____________________F-TEST_______________________
   HO: PROPOR78=PROPOR79 #  _________SS_________  ______DF______
   _T-CALC____DF____PROB_#__BETWEEN_____WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
A:    4.384  4082    0.000 #     66.08  385801.14     1      1365     0.234  0.629
B:    2.872  4082    0.004 #     16.97    8835.18     1       631     1.212  0.271
C:    0.700  4082    0.484 #    163.98   34916.80     1       905     4.250  0.040
D:   -7.505  4082    0.000 #    271.66   44675.42     1      1175     7.145  0.008


 _ZONE_ONE__PUPILS_IN_1978_AND_1979_ACHIEVING_WITHIN_EACH_CATAGORY_A-D_
     CRITERION CATEGORIES FOR  GRADE:4  STRAND: GRAPHING
            TOTAL NUMBER OF PUPILS:  1978 N=2115    1979 N=1969

          A: BELOW 50%      B:  50-64%        C:  65-84%        D: 85-100%
      ____1978____1979_____1978____1979_____1978____1979_____1978____1979_
NUMBER(%)  28.75    20.01     18.53    15.95     24.68    29.00     28.04    35.04
MEAN (%)   29.74    27.25     56.85    57.14     74.21    73.90     95.32    95.48

             TABLES COMPARING 1978 AND 1979 MEAN SCORES AND PROPORTIONS
   ___PROPORTION TEST___ #  ____________________F-TEST_______________________
   HO: PROPOR78=PROPOR79 #  _________SS_________  ______DF______
   _T-CALC____DF____PROB_#__BETWEEN_____WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
A:    6.484  4082    0.000 #   1478.79  246793.02     1      1000     5.992  0.015
B:    2.185  4082    0.029 #     14.83   15299.48     1       704     0.678  0.411
C:   -3.115  4082    0.002 #     26.87   32693.22     1      1091     0.897  0.344
D:   -4.819  4082    0.000 #      6.34   31871.52     1      1281     0.335  0.563
```

the regrouping patterns in the algorithms.

The above notion of teaching in the abstract is supported in part by the results from the common fraction and ratio items. Pupils could write fractions or simple ratios from drawings or pictures however they had difficulty at the symbolic level.

Operations and Properties

Although both the multiplication and division processes were introduced at the grade two level, and extended in grade three, pupils in grade four lack success with the operations. There are perhaps many reasons for this. Certainly the place value deficiency would influence the results. The lack of mastery on the basic facts may be another (Figure 101). The continual 'progressing' of students who do not have sufficient understanding, and the lack of suitable management systems whereby student weakness can be identified, may also be at work.

The complexity of the addition and subtraction items in Figure 96 may be the main reason for the spreading of the scores within the four categories. A more realistic range in difficulty may have given better readings of students understanding.

Measurement

It appears as though some of the measurement concepts introduced at the grade four level are either too difficult or they are not being taught. The achievement means for using equivalent measures within units of capacity, mass, length and time and the expressing of linear measures to thousandths (Figures 108 and 114), seem to be excessive. With about one-third of the grade four pupils still struggling with the choosing of appropriate standardized measuring units (Figure 112), it seems over demanding to expect high results from the more difficult objectives. Even with the significant increases in performance for 1979 the overall performance on the strand is low.

It is unclear from the perimeter item (Figure 109) whether the one-third failure rate is due to a lack of understanding or a lack of measuring skills. An item on perimeter only may have been more appropriate.

Since the reading and writing of time to the quarter hour gave the grade three students trouble, and since many grade four pupils experience the same difficulty with time to minutes, it may be that the teaching of time is somewhat haphazard. This is however assuming that the clock items are drawn with sufficient accuracy to be valid or that pupils are both able and motovated to learn time concepts.

Geometry

Since grade four is the first introduction to transformational geometry, students showed fair understanding of translation, reflection and rotation items.

Many of the pupils who could not identify the axis of symmetry for the rectangle in item 13 of Figure 116 may have been tricked into considering the diagonals as being axis lines. This is the case for the square but not for the rectangle.

Graphing

Performance for both the reading and constructing of the various graphs is up considerably from the earlier grades. Students do however have some difficulties with the two objectives that involve the use of coordinates.

The test items used to measure coordinate understanding may be somewhat inappropriate. Objective three in Figure 120 deals with the writing of coordinates as ordered pairs but the test item requires only a reading of coordinates. Because of this the item may be easier than the one used at the grade three level.

CHAPTER VIII

GRADE FIVE

ANALYSIS OF HYPOTHESIS ONE AND TWO FOR GRADE FIVE

NUMBER (Six objectives; Figures 124 to 129)

Hypothesis 1

None of the objectives had performances where eighty percent of the Zone One pupils in 1978 and 1979 were in the 85-100 percent category.

Hypothesis 2

Five objectives had significant increases in the proportion of pupils achieving at the 85-100 percent level in 1979 over 1978.

Findings

Although more students in 1979 were able to express tenths, hundredths and thousandths as fractions or decimals still about forty percent of the students could do only six or fewer of the ten items. The mean performance for all students was about 66 percent.

Place value related skills continued as a primary difficulty for many students. Two-thirds of the pupils had achievement figures below the 50 percent level on the items measuring the identification and use of place value for the digits 0.001 to 999 999.

Rounding numbers, also a place value skill, was handled reasonably well for whole numbers (seventy percent of the

PART I

PART	QUESTION	STRAND	OBJECTIVE	RAW SCORE VALUE
I	1	Number	1	20
I	2	Number	2	20
I	3	Number	3	8
I	4	Number	3	6
I	5	Number	4	20
I	6	Number	5	16
I	7	Number	6	10
I	8	Number	6	6
			SUB-TOTAL = 106	
			Raw Score ÷ 3 = 35%	
I	9	Operations & Properties	1	8
I	10	Operations & Properties	2	6
I	11	Operations & Properties	3	6
I	12	Operations & Properties	4	4
I	13	Operations & Properties	4	4
I	14	Operations & Properties	6	6
I	15	Operations & Properties	6	6
I	16	Operations & Properties	6	8
I	17	Operations & Properties	6	8
I	18	Operations & Properties	7	6
I	19	Operations & Properties	7	6
I	20	Operations & Properties	7	6
I	21	Operations & Properties	5	4
I	22	Operations & Properties	5	4
I	23	Operations & Properties	5	4
I	24	Operations & Properties	5	4

FIGURE 122

GRADE FIVE DETAILED ANALYSIS OF MARK WEIGHTINGS

PART II

PART	QUESTION	STRAND	OBJECTIVE	RAW SCORE VALUE
II	1	Measurement	1	1
II	2	Measurement	1	1
II	3	Measurement	2	4
II	4	Measurement	3	3
II	5	Measurement	4	4
II	6	Measurement	5	3
II	7	Measurement	6	2
II	8	Measurement	7	3
II	9	Measurement	7	4
II	10	Measurement	8	6
II	11	Measurement	9	1
II	12	Measurement	9	2
II	13	Measurement	9	4
II	14	Measurement	10	4
II	15	Geometry	1	4
II	16	Geometry	1	4
II	17	Geometry	1	2
II	18	Geometry	1	2
II	19	Geometry	2	8
II	20	Geometry	3	8
II	21	Geometry	4	3
II	22	Geometry	4	2
II	23	Geometry	4	2
			SUB-TOTAL = 35	
			Sub-Total ÷ 3 = 12%	
II	24	Graphing	1	3
II	25	Graphing	1	3
II	26	Graphing	1	3
II	27	Graphing	2	3
II	28	Graphing	2	3
II	29	Graphing	3	4
II	30	Graphing	4	4
II	31	Graphing	5	4

FIGURE 123

GRADE FIVE DETAILED ANALYSIS OF MARK WEIGHTINGS

LEVEL E (Grade 5)

NUMBER

OBJECTIVE 1 *Expresses tenths, hundredths, and thousandths as fractions or decimals.*

TEST ITEMS

1. Express each of the following numbers first as a common fraction then as a decimal fraction.

1. six tenths __________ , __________
2. thirty-one hundredths __________ , __________
3. fourteen thousandths __________ , __________
4. sixty hundredths __________ , __________
5. four hundredths __________ , __________

ANALYSIS

```
 _ZONE_ONE__PUPILS_IN_1978_AND_1979_ACHIEVING_WITHIN_EACH_CATAGORY_A-D_
     CRITERION CATEGORIES FOR    GRADE:5   STRAND:1   OBJECTIVE: 1
          TOTAL NUMBER OF PUPILS:  1978 N=2129   1979 N=1862

           A: BELOW 50%       B:  50-64%        C:  65-84%       D: 85-100%
        ____1978___1979_____1978____1979_____1978____1979_____1978____1979_
NUMBER(%)  28.60    23.36    20.62   18.21    16.72   16.38    34.05   42.05
MEAN (%)   10.96    13.84    52.27   52.32    75.21   75.49    96.68   97.23

          TABLES COMPARING 1978 AND 1979 MEAN SCORES AND PROPORTIONS
   ___PROPORTION TEST___ #  __________________F-TEST______________________
   HO: PRCPOR78=PROPOR79 #  ________SS________  ______DF______
   _T-CALC____DF____PROB_#__BETWEEN_____WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
A:   3.760   3989   0.000 #  2102.50  285551.79     1      1042    7.672  0.006
B:   1.920   3989   0.055 #     0.46   12927.04     1       776    0.028  0.868
C:   0.289   3939  .0.773 #    12.98   17535.43     1       659    0.488  0.485
D:  -5.199   3989   0.000 #   117.69   28927.59     1      1506    6.127  0.013

    ______COMPARING_THE_MEAN_SCORES_OF_PUPILS_WITHIN_ZONE_SUBGROUPS______
                              ___________________F-TEST TABLE________________
GROUPS       YEARS        #  ________SS________  ______DF______
======______1978____1979__#__BETWEEN_____WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
EARLY       57.34   64.21 # 30427.61 3321481.27     1      2598   23.800  0.000
LATE        64.51   69.02 #  6427.93 1411971.86     1      1268    5.773  0.016
MALE        54.63   63.26 # 37699.44 2646836.34     1      2030   28.914  0.000
FEMALE      64.35   68.88 #  9982.83 2219231.36     1      1957    8.803  0.003
NORTH       50.05   63.22 # 62146.79 2021250.33     1      1439   44.245  0.000
SOUTH       64.76   67.57 #  5024.92 2794959.39     1      2548    4.581  0.033
PUBLIC      59.84   64.42 # 17209.54 4089385.18     1      3290   13.845  0.000
SEPARATE    57.38   73.41 # 44732.12  817841.13     1       697   38.123  0.000
```

FIGURE 124

LEVEL E (Grade 5)

NUMBER

OBJECTIVE 2 *Rounds whole numbers. (Limit: 5-digit accuracy).*

TEST ITEMS

2. Round the following numbers to the nearest thousand.

A. 2 901 ____________

B. 7 499 ____________

C. 4 099 ____________

D. 8 610 ____________

E. 1 490 ____________

ANALYSIS

```
    _ZONE_ONE__PUPILS_IN_1978_AND_1979_ACHIEVING_WITHIN_EACH_CATAGORY_A-D_
        CRITERION CATEGCRIES FOR     GRADE:5   STRAND:1   DEJECTIVE: 2
             TOTAL NUMBER OF PUPILS:  1978 N=2129   1979 N=1862

             A: BELOW 50%       B:  50-64%         C:  65-84%         D: 85-100%
          ____1978____1979_____1978____1979_____1978____1979_____1978____1979_
NUMBER(%)  28.46    23.09      6.06     5.91      8.74     9.13    56.74    61.87
MEAN (%)    9.27    10.34     59.77    59.82     80.00    79.97   100.00    99.92

             TABLES COMPARING 1978 AND 1979 MEAN SCORES AND PROPORTIONS
     ___PROPORTION TEST___ #  ____________________F-TEST______________________
     HO: PROPOR78=PROPOR79 #  ________SS________  ______DF______
     _T-CALC____DF____PROB_#__BETWEEN_____WITHIN_BETWEEN_WITHIN__F-RATIO__PROB
A:     3.861   3989   0.000 #     284.37  233656.63      1      1034    1.258  0.262
B:     0.201   3989   0.841 #       0.15     489.39      1       237    0.074  0.786
C:    -0.435   3989   0.664 #       0.08      24.85      1       354    1.094  0.296
D:    -3.288   3989   0.001 #       3.60     892.97      1      2358    9.504  0.002

     _____COMPARING_THE_MEAN_SCORES_OF_PUPILS_WITHIN_ZONE_SUBGROUPS______
                              __________________F-TEST TABLE________________
GROUPS          YEARS      #  ________SS________  ______DF______
======_____1978____1979__#__BETWEEN_____WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
EARLY       67.95   74.31 #  26014.37 4156323.85      1      2598   16.261  0.000
LATE        74.47   76.20 #    945.06 1780658.48      1      1268    0.673  0.412
MALE        71.34   76.56 #  13824.30 3074948.93      1      2030    9.126  0.003
FEMALE      68.60   73.46 #  11506.44 3048685.62      1      1957    7.386  0.007
NORTH       59.76   71.04 #  45592.96 2516681.61      1      1439   26.069  0.000
SOUTH       75.83   77.28 #   1320.75 3471516.51      1      2548    0.969  0.325
PUBLIC      70.12   73.77 #  10859.98 5122890.84      1      3290    6.974  0.008
SEPARATE    69.35   80.97 #  23522.48  994933.60      1       697   16.479  0.000
```

FIGURE 125

LEVEL E (Grade 5)

NUMBER

OBJECTIVE 3 *Identifies and uses place value of digits (0.001 - 999 999).*

TEST ITEMS

3. Write the numbers in decimals that contain

(a) four hundred thousands
six hundreds
eleven ones
forty hundredths

____

(b) seven ones
eleven thousands
eight tenths
two hundreds

____

4. In the number 826 443 091

0 is in the ____________ place.
6 is in the ____________ place.
3 is in the ____________ place.
9 is in the ____________ place.
1 is in the ____________ place.
2 is in the ____________ place.

ANALYSIS

```
      _ZONE ONE   PUPILS IN 1978 AND 1979 ACHIEVING WITHIN EACH CATAGORY A-D_
          CRITERION CATEGORIES FOR     GRADE:5    STRAND:1    OBJECTIVE: 3
                TOTAL NUMBER OF PUPILS:  1978 N=2129    1979 N=1862

            A: BELOW 50%        B:  50-64%         C:  65-84%         D: 85-100%
         ____1978____1979_____1978____1979_____1978____1979_____1978____1979_
NUMBER(%)   77.08    66.38     4.37     6.50     8.83    10.63     9.72    16.49
MEAN (%)    23.23    23.80    59.75    58.21    71.69    71.72    98.34    98.72

                TABLES COMPARING 1978 AND 1979 MEAN SCORES AND PROPORTIONS
     ___PROPORTION TEST___  #  ____________________F-TEST______________________
     HO: PRCPOR78=PROPOR79  #  ________SS________  ______DF______
     _T-CALC____DF____PROB_ # _BETWEEN_____WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
A:     7.517   3989   0.000 #    223.47  806941.10     1      2875    0.796  0.373
B:    -2.980   3989   0.003 #    126.14    6372.05     1       212    4.197  0.042
C:    -1.923   3989   0.055 #      0.05     735.52     1       384    0.026  0.872
D:    -6.365   3989   0.000 #     17.54    6939.60     1       512    1.294  0.256


     ______COMPARING THE MEAN SCORES OF PUPILS WITHIN ZONE SUBGROUPS______
                                 ____________________F-TEST TABLE_________________
GROUPS           YEARS          #  ________SS________  ______DF______
======______1978____1979__#__BETWEEN______WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
EARLY          34.41    41.10 #  28836.47 2360741.07     1      2598   31.735  0.000
LATE           41.03    46.05 #   7957.50 1232110.64     1      1268    6.189  0.004
MALE           36.09    44.53 #  36061.82 1942074.03     1      2030   37.694  0.000
FEMALE         36.74    42.39 #  15520.05 1839860.98     1      1957   16.508  0.000
NORTH          29.71    39.92 #  37393.43 1345045.70     1      1439   40.005  0.000
SOUTH          40.24    45.47 #  17347.10 2371409.78     1      2548   18.639  0.000
PUBLIC         35.98    42.49 #  34719.26 3123853.35     1      3290   36.566  0.000
SEPARATE       38.48    48.10 #  16097.86  650005.92     1       697   17.262  0.000
```

FIGURE 126

LEVEL E (Grade 5)

NUMBER

OBJECTIVE 4 *Expresses and generates proportional ratios.*

TEST ITEMS

5. The price of bubble gum is 4 packages for 9¢. Complete the following table, expressing each relationship as a proportional ratio. Fill in all the boxes.

No. of packages of gum	Cost	Proportional Ratio
4	9¢	$\frac{4}{9}$
12		
	18¢	
24		
	36¢	
36		

ANALYSIS

```
 _ZONE_ONE__PUPILS_IN_1978_AND_1979_ACHIEVING_WITHIN_EACH_CATAGORY_A-D_
      CRITERION CATEGORIES FOR     GRADE:5    STRAND:1    OBJECTIVE: 4
            TOTAL NUMBER OF PUPILS:  1978 N=2129    1979 N=1862

           A: BELOW 50%        B:  50-64%         C:  65-84%        D: 85-100%
         ____1978____1979_____1978____1979_____1978____1979_____1978____1979_
NUMBER(%)  58.99    55.91     10.57    12.08     12.07     9.67     18.37    22.34
MEAN (%)   10.86    12.12     58.13    57.67     78.58    78.22     99.05    99.12

            TABLES COMPARING 1978 AND 1979 MEAN SCORES AND PROPORTIONS
   ___PROPORTION TEST___ #  ____________________F-TEST_____________________
   HO: PROPOR78=PROPOR79 #  ________SS________  ______DF______
   _T-CALC____DF_____PROB_#__BETWEEN______WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
A:    1.969   3989   0.049 #     906.94  536759.38     1       2295     3.878  0.049
B:   -1.510   3989   0.131 #      24.50    7416.00     1        448     1.480  0.224
C:    2.427   3989   0.016 #      13.53    5787.73     1        435     1.017  0.314
D:   -3.120   3989   0.002 #       0.96    6654.62     1        805     0.116  0.734


   _____COMPARING_THE_MEAN_SCORES_OF_PUPILS_WITHIN_ZONE_SUBGROUPS______
                                ___________________F-TEST TABLE_________________
GROUPS          YEARS        #  ________SS________  ______DF______
======_____1978_____1979__#__BETWEEN_______WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
EARLY       37.43    42.19 #  14554.61 3871280.01     1       2598     9.768  0.002
LATE        46.89    44.39 #   1972.18 1904311.36     1       1268     1.313  0.252
MALE        39.88    45.51 #  16064.25 2975885.55     1       2030    10.958  0.001
FEMALE      40.59    41.30 #    250.88 3033411.01     1       1957     0.162  0.688
NORTH       34.31    35.91 #    915.16 2037881.44     1       1439     0.646  0.422
SOUTH       43.61    47.66 #  10445.91 3878201.50     1       2548     6.863  0.009
PUBLIC      39.92    43.21 #   8904.02 4951805.40     1       3290     5.916  0.015
SEPARATE    41.69    44.55 #   1416.66 1064548.21     1        657     0.928  0.336
```

FIGURE 127

LEVEL E (Grade 5)

NUMBER

OBJECTIVE 5 *Solves for the missing numeral in proportional ratios without using cross-products.*

TEST ITEMS

6. Solve for n in the following ratios:

A. $\frac{2}{4} :: \frac{4}{n}$ n = ____________

B. $\frac{4}{16} :: \frac{1}{n}$ n = ____________

C. $\frac{180}{810} :: \frac{n}{5}$ n = ____________

D. $\frac{42}{54} :: \frac{n}{9}$ n = ____________

ANALYSIS

```
 ZONE ONE  PUPILS IN 1978 AND 1979 ACHIEVING WITHIN EACH CATAGORY A-D
      CRITERION CATEGORIES FOR    GRADE:5   STRAND:1   OBJECTIVE: 5
          TOTAL NUMBER OF PUPILS:  1978 N=2129   1979 N=1862

                                                          D: 85-100%
              A: BELOW 50%     B:  50-64%      C:  65-84%
                                1978    1979    1978    1979    1978    1979
           1978    1979                                    
                                18.98   19.50   16.96   16.06   19.96   20.52
NUMBER(%)  44.11   43.93
MEAN (%)    9.93   10.94        50.08   50.24   75.00   75.00  100.00  100.00

          TABLES COMPARING 1978 AND 1979 MEAN SCORES AND PROPORTIONS
                              #  ______________________F-TEST____________________
   ___PROPORTION TEST___      #  ________SS________    ______DF______
   HO: PRCPOR78=PROPOR79      #  BETWEEN      WITHIN   BETWEEN WITHIN  F-RATIO  PROB
    T-CALC    DF     PROB     #
A:   0.110   3989    0.912    #   446.43   267673.81      1     1755     2.927   0.087
B:  -0.415   3989    0.678    #     5.12     1421.80      1      765     2.757   0.097
C:   0.762   3989    0.446    #  <<<<<<<<<<<<<< SSW IS EQUAL TO ZERO >>>>>>>>>>>>>>
D:  -0.434   3989    0.664    #  <<<<<<<<<<<<<< SSW IS EQUAL TO ZERO >>>>>>>>>>>>>>

          COMPARING THE MEAN SCORES OF PUPILS WITHIN ZONE SUBGROUPS_______
     ________________________________________F-TEST TABLE__________________
                                 ____________________
GROUPS          YEARS        #  ________SS________    ______DF______
======       1978     1979   #  BETWEEN      WITHIN   BETWEEN WITHIN  F-RATIO  PROB
EARLY       44.48    45.29   #    427.17  3536735.92     1     2598     0.314   0.575
LATE        51.76    49.01   #   2397.58  1664070.83     1     1268     1.827   0.177
MALE        43.44    45.80   #   2814.50  2757888.15     1     2030     2.072   0.150
FEMALE      49.79    48.57   #    714.27  2631614.20     1     1957     0.531   0.466
NORTH       41.03    43.36   #   1941.14  2086938.49     1     1439     1.338   0.248
SOUTH       49.72    49.28   #    122.81  3275259.25     1     2548     0.096   0.757
PUBLIC      46.10    46.98   #    623.63  4521946.75     1     3290     0.454   0.501
SEPARATE    48.75    48.01   #     94.17   890107.45     1      697     0.074   0.786
```

FIGURE 128

LEVEL E (Grade 5)

NUMBER

OBJECTIVE 6 *Rounds to tenths and hundredths.*

TEST ITEMS

7. Round each decimal to the nearest tenth.

A. 7.47 ____________

B. 6.89 ____________

C. 7.96 ____________

D. 0.81 ____________

E. 4.03 ____________

8. Round 7.156

to the nearest hundredth ____________

to the nearest tenth ____________

ANALYSIS

```
 _ZONE_ONE__PUPILS_IN_1978_AND_1979_ACHIEVING_WITHIN_EACH_CATAGORY_A-D_
      CRITERION CATEGORIES FOR     GRADE:5   STRAND:1   OBJECTIVE: 6
           TOTAL NUMBER OF PUPILS:  1978 N=2129    1979 N=1862

             A: BELOW 50%       B:  50-64%        C:  65-84%        D: 85-100%
         ____1978____1979_____1978____1979_____1978____1979_____1978____1979_
NUMBER(%)  52.89    49.19     25.60   25.78     7.89     6.98    13.62   18.05
MEAN (%)    9.64    12.21     55.55   55.48    73.96    74.71    95.13   95.67

          TABLES COMPARING 1978 AND 1979 MEAN SCORES AND PROPORTIONS
   ___PROPORTION TEST___ #  ______________________F-TEST______________________
   HO: PRCPOR78=PROPOR79 #  _________SS________  ______DF______
   _T-CALC____DF____PROB_#__BETWEEN______WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
A:    2.329   3989   0.020 #   3341.33  462559.69     1       2040   14.736  0.000
B:   -0.130   3989   0.897 #      1.20   36637.52     1       1023    0.034  0.855
C:    1.090   3989   0.276 #     41.58    8791.27     1        296    1.400  0.238
D:   -3.834   3989   0.000 #     44.82   22628.96     1        624    1.236  0.267

   ______COMPARING_THE_MEAN_SCORES_OF_PUPILS_WITHIN_ZONE_SUBGROUPS______
                                 __________________F-TEST TABLE__________________
GROUPS         YEARS         #  _________SS________  ______DF______
======_____1978____1979__#__BETWEEN______WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
EARLY       36.50    41.18 #  14109.89 3081330.00     1       2598   11.897  0.001
LATE        41.91    44.69 #   2434.56 1533130.77     1       1268    2.014  0.156
MALE        37.17    43.47 #  20096.15 2476021.11     1       2030   16.476  0.000
FEMALE      39.09    42.08 #   4357.57 2294419.51     1       1957    3.717  0.054
NORTH       37.43    37.42 #      0.05 1762491.17     1       1439    0.000  0.995
SOUTH       38.51    45.79 #  33692.44 2980220.57     1       2548   28.806  0.000
PUBLIC      37.24    41.13 #  12372.05 4003828.83     1       3290   10.166  0.002
SEPARATE    42.26    50.49 #  11807.91  738006.45     1        697   11.152  0.001
```

FIGURE 129

pupils correctly rounded 4 or 5 of the five numbers on the items). The rounding of numbers to tenths and hundredths seemed to compound the difficulties, however. About one-half of the students in 1979 answered but three or fewer of the six items correctly.

Many grade five pupils found the expressing and generating of proportional ratios troublesome. Over one-half of the students achieved well below the 50 percent level. Thirty-two percent of the pupils performed in categories C or D. An only slightly higher proportion of pupils could solve for a missing numeral in proportional ratios.

OPERATIONS AND PROPERTIES (Seven objectives; Figures 130 to 136).

Hypothesis 1

None of the objectives had performances whereby eighty percent of the Zone One pupils in 1978 and 1979 were in the 85-100 percent achievement category.

Hypothesis 2

Two objectives had significant increases in the proportion of pupils achieving at the 85-100 percent level in 1979 over 1978.

Findings

About seventy-six percent of the pupils in 1979 (five percent more than in 1978) could solve at least three of the four addition and subtraction items of two and three digit size. Only six percent of the students could not do more than one of the problems.

A few more grade five pupils in both years had difficulty with multiplying whole numbers by one, two and three digit multipliers. Still about seventy percent of the Zone One pupils properly used the multiplication algorithms for at least two of the three items.

About one of every two children in grade five could not use the algorithm for dividing whole numbers by one and two digit divisors (with and without remainders). Forty-eight percent of the pupils could give correct answers for two of the three problems provided in the test.

One-third of the pupils in 1979 had below 50 percent scores on estimating products and quotients in problems involving the rounding up or down of factors, divisors and dividends. Forty-three percent of the pupils could do three-quarters or more of the problems.

Performance on the basic facts remained fairly constant over the two years. With speed and accuracy combined, two-thirds of the grade five pupils reached levels C and D (65-100 percent). Forty-five percent of these pupils performed within category D however.

The grade five pupils certainly did not solve the word problems or estimate answers with any degree of success in either year. Two-thirds of the pupils had achievement scores below 50 percent range and only 7 of every 100 pupils came within category D.

The 1979 group of pupils had significantly better

OPERATIONS AND PROPERTIES

LEVEL E (Grade 5)

OBJECTIVE 1 *Adds and subtracts whole numbers.*

TEST ITEMS

9. Solve the following:

(a) 76 + 32

(b) 192 − 64

(c) 980 + 208

(d) 529 − 263

ANALYSIS

```
 ZONE ONE  PUPILS IN 1978 AND 1979 ACHIEVING WITHIN EACH CATAGORY A-D
     CRITERION CATEGORIES FOR     GRADE:5   STRAND:2   OBJECTIVE: 1
          TOTAL NUMBER OF PUPILS:  1978 N=2129    1979 N=1862

           A: BELOW 50%      B:  50-64%        C:  65-84%        D: 85-100%
        ____1978____1979____1978____1979_____1978____1979_____1978____1979_
NUMBER(%)   6.81    6.07    22.31   17.88    20.06   21.32    50.82   54.73
MEAN (%)   14.40   15.27    50.00   50.08    75.00   75.00    99.99   99.99

            TABLES COMPARING 1978 AND 1979 MEAN SCORES AND PROPORTIONS
   ___PROPORTION TEST___ #  __________________F-TEST_____________________
   HO: PRCPOR78=PROPOR79 #  ________SS________  ______DF______
   _T-CALC____DF____PROB_#__BETWEEN_____WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
A:   0.951   3989   0.342 #    47.95   40645.48    1       256    0.302  0.583
B:   3.472   3989   0.001 #     1.10    310.62     1       806    2.863  0.091
C:  -0.985   3989   0.325 # <<<<<<<<<<<<<< SSW IS EQUAL TO ZERO >>>>>>>>>>>>>>
D:  -2.464   3989   0.014 #     0.00    312.20     1      2099    0.002  0.966

   _____COMPARING THE MEAN SCORES OF PUPILS WITHIN ZONE SUBGROUPS______
                            __________________F-TEST TABLE_________________
GROUPS        YEARS       #  ________SS________  ______DF______
======______1978____1979__#__BETWEEN_____WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
EARLY       77.26   79.90 #  4476.38 1833535.10    1      2598    6.343  0.012
LATE        79.76   82.25 #  1956.15  795956.75    1      1268    3.116  0.078
MALE        76.36   79.74 #  5757.33 1423235.97    1      2030    8.212  0.004
FEMALE      79.68   81.48 #  1584.46 1284830.80    1      1957    2.413  0.121
NORTH       74.61   78.75 #  6127.82 1090825.91    1      1439    8.084  0.005
SOUTH       79.93   81.62 #  1824.64 1607070.03    1      2548    2.893  0.089
PUBLIC      78.30   81.18 #  6798.79 2215721.85    1      3290   10.095  0.002
SEPARATE    76.56   77.88 #   303.78  495744.15    1       657    0.427  0.814
```

FIGURE 130

OPERATIONS AND PROPERTIES **LEVEL E (Grade 5)**

OBJECTIVE 2 *Multiplies whole numbers using one, two, and three digit multipliers.*

TEST ITEMS

10. Multiply the following:

(a)	(b)	(c)
52 X 6	206 X 58	117 X 234

ANALYSIS

```
 _ZONE_ONE__PUPILS_IN_1978_AND_1979_ACHIEVING_WITHIN_EACH_CATAGORY_A-D_
     CRITERION CATEGORIES FOR     GRADE:5    STRAND:2    OBJECTIVE: 2
            TOTAL NUMBER OF PUPILS:  1978 N=2129    1979 N=1862

            A: BELOW 50%      B:  50-64%        C:  65-84%        D: 85-100%
       ____1978____1979____1978____1979____1978____1979____1978____1979_
NUMBER(%)  31.05    28.79    0.14     0.27     30.39    31.79    38.42    39.15
MEAN (%)   24.16    26.12    50.00    50.00    66.77    66.92   100.00   100.00

             TABLES COMPARING 1978 AND 1979 MEAN SCORES AND PROPORTIONS
   ___PROPORTION TEST___ #  ___________________F-TEST____________________
   HO: PROPOR78=PROPOR79 #  ________SS________  ______DF______
   _T-CALC____DF____PROB_#__BETWEEN_____WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
A:    1.555   3989   0.120 #   1141.80  247537.30     1     1195     5.512  0.019
B:   -0.899   3989   0.369 #  <<<<<<<<<<<<<< SSW IS EQUAL TO ZERO >>>>>>>>>>>>>>
C:   -0.956   3989   0.339 #      6.99    3566.24     1     1237     2.424  0.120
D:   -0.472   3989   0.637 #  <<<<<<<<<<<<<< SSW IS EQUAL TO ZERO >>>>>>>>>>>>>>


    ______COMPARING_THE_MEAN_SCORES_OF_PUPILS_WITHIN_ZONE_SUBGROUPS_______
                             ____________________F-TEST TABLE_________________
GROUPS          YEARS        #  ________SS________  ______DF______
======_____1978____1979__#__BETWEEN_____WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
EARLY        64.47    66.81 #   3513.85 2739212.22     1     2598     3.333  0.068
LATE         70.48    70.80 #     31.50 1149464.56     1     1268     0.035  0.852
MALE         63.82    66.23 #   2940.66 2098808.57     1     2030     2.844  0.092
FEMALE       68.83    70.01 #    677.98 1925170.53     1     1957     0.689  0.407
NORTH        60.29    64.77 #   7173.70 1627261.49     1     1439     6.344  0.012
SOUTH        69.70    69.93 #     32.28 2361709.44     1     2548     0.035  0.852
PUBLIC       66.20    68.41 #   3981.02 3328590.45     1     3290     3.935  0.048
SEPARATE     66.67    66.57 #      1.78  714441.08     1      657     0.002  0.967
```

FIGURE 131

LEVEL E (Grade 5)

OPERATIONS AND PROPERTIES

OBJECTIVE 3 *Divides whole numbers using one and two digit divisors (with and without remainders).*

TEST ITEMS

11. Solve the following and show the remainders if there are any.

(a) $4\overline{)\,617}$ (b) $28\overline{)\,1\ 764}$ (c) $46\overline{)\,29\ 388}$

ANALYSIS

```
 _ZONE_ONE__PUPILS_IN_1978_AND_1979_ACHIEVING_WITHIN_EACH_CATAGCRY_A-D_.
     CRITERION CATEGORIES FOR     GRADE:5    STRAND:2    OBJECTIVE: 3
           TOTAL NUMBER OF PUPILS:  1978 N=2129     1979 N=1862
                                                           D: 85-100%
                                          C:  65-84%
                           B:  50-64%
          A: BELOW 50%                                   1978____1979_
                                        1978____1979_____1978____1979_     19.55
      ____1978____1979_____1978____1979_     26.77   28.09    18.08   100.00
NUMBER(%)  54.77    52.20    0.38     0.16    66.93   66.86   100.00
MEAN (%)   16.98    18.43   50.00    50.00

            TABLES COMPARING 1978 AND 1979 MEAN SCORES AND PROPORTIONS
                                        _______________________F-TEST____________________
   ___PROPORTION TEST___ #  ______________________ ______DF______
   HO: PRCPOR78=PROPOR79 #  ________SS________  BETWEEN_WITHIN__F-RATIO__PROB
   _T-CALC____DF____PROB # _BETWEEN____WITHIN_        1    2136     4.064   0.044
A:   1.621   3989   0.105 #  1117.08  587130.64  EQUAL TO ZERO >>>>>>>>>>>>>>
B:   1.290   3989   0.197 # <<<<<<<<<<<<<< SSW IS         1    1091     0.375   0.540
C:  -0.929   3989   0.353 #     1.41    4108.07   EQUAL TO ZERO >>>>>>>>>>>>>>
D:  -1.183   3989   0.237 # <<<<<<<<<<<<<< SSW IS

            COMPARING_THE_MEAN_SCORES_OF_PUPILS_WITHIN_ZONE_SUBGROUPS_______
      ______________________________________F-TEST TABLE_________________
                             ______________________  ______DF______
GROUPS        YEARS        #  ________SS________   BETWEEN_WITHIN__F-RATIO__PROB
======_____1978____1979__#__BETWEEN______WITHIN__         2598     7.375   0.007
EARLY       42.82    46.60 #   9193.15 3238444.03    1     1268     0.103   0.748
LATE        51.72    51.10 #    124.34 1529777.02    1     2030     8.054   0.005
MALE        41.85    46.26 #   9845.30 2481558.35    1     1957     0.150   0.699
FEMALE      49.25    49.87 #    187.51 2448287.90    1     1439     2.305   0.129
NORTH       38.65    41.48 #   2863.70 1787456.30    1     2548     2.759   0.097
SOUTH       49.40    51.69 #   3330.80 3076104.49    1     3290     5.411   0.020
PUBLIC      45.23    48.09 #   6690.24 4067625.95    1      657     0.144   0.705
SEPARATE    46.75    47.78 #    184.75  896690.15    1
```

FIGURE 132

OPERATIONS AND PROPERTIES

LEVEL E (Grade 5)

OBJECTIVE 4 *Estimates products and quotients.*

TEST ITEMS

12. Rewrite each question, rounding each number and showing your estimated answer. The first one is done for you as an example.

18 x 196 = 20 x 200 = 4 000

12 x 18 = ______ x ______ = ______

183 x 12 = ______ x ______ = ______

293 x 213 = ______ x ______ = ______

28 x 306 = ______ x ______ = ______

13. Rewrite each question, rounding each number and showing your estimated answer. The first one is done for you as an example.

$5\overline{)333}$ Question $\quad$ $\overset{30}{10\overline{)300}}$ Answer

$12\overline{)738}$ $\quad$ $\overline{)\quad}$

$21\overline{)3\,426}$ $\quad$ $\overline{)\quad}$

ANALYSIS

```
 _ZONE_ONE__PUPILS_IN_1978_AND_1979_ACHIEVING_WITHIN_EACH_CATAGORY_A-D_
     CRITERION CATEGORIES FOR     GRADE:5   STRAND:2   OBJECTIVE: 4
          TOTAL NUMBER OF PUPILS:  1978 N=2129   1979 N=1862

           A: BELOW 50%      B:  50-64%       C:  65-84%       D: 85-100%
       ____1978____1979_____1978___1979_____1978___1979_____1978____1979_
NUMBER(%)  36.68   34.37    21.56   22.66    20.10   20.19    21.65   22.77
MEAN (%)   15.80   16.35    55.83   55.69    75.00   75.00    96.26   96.20

            TABLES COMPARING 1978 AND 1979 MEAN SCORES AND PROPORTIONS
   ___PROPORTION TEST___  #  ____________________F-TEST_____________________
   HO: PRCPOR78=PROPOR79  #  ________SS________  ______DF______
   _T-CALC___DF____PROB_#__BETWEEN_____WITHIN_BETWEEN_WITHIN__F-RATIO__PROB
A:   1.522  3989   0.128 #    106.64  319691.48    1      1419    0.473  0.492
B:  -0.839  3989   0.402 #      4.35   34198.61    1       879    0.112  0.738
C:  -0.071  3989   0.944 # <<<<<<<<<<<<<< SSW IS EQUAL TO ZERO >>>>>>>>>>>>>>
D:  -0.848  3989   0.397 #      0.83   29131.59    1       883    0.025  0.874


   ______COMPARING_THE_MEAN_SCORES_OF_PUPILS_WITHIN_ZONE_SUBGROUPS_______
                              ___________________F-TEST TABLE__________________
GROUPS        YEARS       #  ________SS________  ______DF______
======______1978____1979__#__BETWEEN_____WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
EARLY        51.61   53.72 #  2870.23 2936150.87    1      2598    2.540  0.111
LATE         58.83   57.00 #  1055.60 1251660.93    1      1268    1.069  0.301
MALE         51.28   54.97 #  6892.78 2199563.83    1      2030    6.361  0.012
FEMALE       56.30   55.62 #   228.18 2149282.89    1      1957    0.208  0.649
NORTH        47.19   50.34 #  3549.03 1725374.68    1      1439    2.960  0.086
SOUTH        57.50   58.05 #   195.17 2559226.46    1      2548    0.194  0.659
PUBLIC       53.15   54.23 #   955.69 3650054.48    1      3290    0.861  0.354
SEPARATE     56.64   60.23 #  2242.32  698903.52    1       697    2.236  0.135
```

FIGURE 133

LEVEL E (Grade 5)

OPERATIONS
AND PROPERTIES

OBJECTIVE 5 *Demonstrates mastery of basic facts.*

TEST ITEMS

21. Add the following. You have 1 minute.

3 + 9 = ____ 4 + 6 = ____ 7 + 9 = ____ 7 + 4 = ____
9 + 3 = ____ 9 + 5 = ____ 5 + 1 = ____ 2 + 3 = ____
7 + 7 = ____ 8 + 2 = ____ 6 + 8 = ____ 9 + 8 = ____
9 + 1 = ____ 4 + 0 = ____ 8 + 3 = ____ 8 + 5 = ____
8 + 6 = ____ 5 + 9 = ____ 5 + 4 = ____ 8 + 7 = ____
2 + 8 = ____ 2 + 9 = ____ 5 + 7 = ____ 7 + 3 = ____

22. Subtract the following. You have 1 minute.

12 - 7 = ____ 9 - 6 = ____ 15 - 8 = ____ 16 - 8 = ____
11 - 6 = ____ 13 - 6 = ____ 16 - 7 = ____ 8 - 6 = ____
12 - 5 = ____ 16 - 9 = ____ 15 - 6 = ____ 12 - 4 = ____
7 - 2 = ____ 11 - 5 = ____ 9 - 8 = ____ 17 - 9 = ____
13 - 7 = ____ 13 - 9 = ____ 12 - 8 = ____ 14 - 8 = ____
12 - 6 = ____ 6 - 4 = ____ 14 - 5 = ____ 5 - 3 = ____

23. Multiply the following. You have 1 minute.

3 x 4 = ____ 0 x 3 = ____ 9 x 4 = ____ 9 x 8 = ____
6 x 6 = ____ 7 x 9 = ____ 8 x 8 = ____ 8 x 5 = ____
3 x 2 = ____ 4 x 9 = ____ 9 x 6 = ____ 6 x 3 = ____
7 x 6 = ____ 1 x 5 = ____ 7 x 4 = ____ 3 x 5 = ____
2 x 9 = ____ 5 x 6 = ____ 3 x 8 = ____ 8 x 7 = ____
7 x 7 = ____ 5 x 8 = ____ 8 x 2 = ____ 8 x 9 = ____

24. Divide the following. You have 1 minute.

12 ÷ 3 = ____ 63 ÷ 9 = ____ 27 ÷ 9 = ____ 18 ÷ 6 = ____
20 ÷ 4 = ____ 18 ÷ 2 = ____ 49 ÷ 7 = ____ 5 ÷ 5 = ____
24 ÷ 4 = ____ 64 ÷ 8 = ____ 24 ÷ 3 = ____ 30 ÷ 5 = ____
24 ÷ 8 = ____ 15 ÷ 5 = ____ 28 ÷ 4 = ____ 42 ÷ 6 = ____
35 ÷ 5 = ____ 30 ÷ 6 = ____ 21 ÷ 7 = ____ 48 ÷ 6 = ____
9 ÷ 1 = ____ 36 ÷ 6 = ____ 56 ÷ 8 = ____ 32 ÷ 8 = ____

ANALYSIS

```
_ZONE_ONE__PUPILS_IN_1978_AND_1979_ACHIEVING_WITHIN_EACH_CATAGORY_A-D_
     CRITERION CATEGORIES FOR     GRADE:5   STRAND:2   OBJECTIVE: 5
          TOTAL NUMBER OF PUPILS:  1978 N=2129    1979 N=1862

            A: BELOW 50%        B:  50-64%        C:  65-84%        D: 85-100%
        ____1978____1979_____1978____1979_____1978____1979_____1978____1979_
NUMBER(%)   11.79   19.44    16.30   15.79    25.46   19.87    46.45   44.90
MEAN (%)    32.77   28.80    56.70   56.93    75.15   75.41    95.46   96.09

          TABLES COMPARING 1978 AND 1979 MEAN SCORES AND PROPORTIONS
   ___PROPORTION TEST___ #  ____________________F-TEST______________________
   HO: PROPOR78=PROPOR79 #  ________SS________  ______DF______
   _T-CALC___DF____PROB_#__BETWEEN_____WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
A:   -6.688  3989   0.000 #   2336.85  101034.13    1       611   14.132  0.000
B:    0.437  3989   0.662 #      8.42   15613.90    1       639    0.345  0.557
C:    4.194  3989   0.000 #     14.35   22778.57    1       910    0.573  0.449
D:    0.984  3989   0.325 #    178.35   46506.03    1      1823    6.991  0.008

   ______COMPARING_THE_MEAN_SCORES_OF_PUPILS_WITHIN_ZONE_SUBGROUPS______
                                 ___________________F-TEST TABLE________________
GROUPS       YEARS         #   ________SS________  ______DF______
======_____1978____1979__#__BETWEEN_____WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
EARLY       75.32   71.54 #   9152.50 1632347.26    1      2598   14.567  0.000
LATE        79.46   74.24 #   8606.47  680299.44    1      1268   16.041  0.000
MALE        73.73   71.74 #   2008.00 1300168.12    1      2030    3.135  0.077
FEMALE      79.53   73.73 #  16389.15 1069541.09    1      1957   29.988  0.000
NORTH       74.14   73.92 #     16.34  911928.92    1      1439    0.026  0.872
SOUTH       77.98   72.04 #  22404.41 1468747.55    1      2548   38.867  0.000
PUBLIC      76.40   71.91 #  16497.17 2037976.68    1      3290   26.632  0.000
SEPARATE    77.47   76.46 #    179.32  345518.22    1       657    0.362  0.548
```

FIGURE 134

LEVEL E (Grade 5)

OPERATIONS AND PROPERTIES

OBJECTIVE 6 *Solves word problems. Estimates answers.*

TEST ITEMS

14. Choose the best estimate from those given for each problem. Write the best answer in the blank at the side.

    A. One tank of water can hold about 12 fish. Choose the best estimate for the number of fish 88 tanks would hold.

    (a) 800 fish (b) 100 fish (c) 900 fish (d) 1 300 fish ________

    B. One truck holds 36 sacks of cement. Estimate the number of trucks needed to hold 278 sacks.

    (a) 7 (b) 25 (c) 70 (d) 80 ________

15. Choose the best estimate from the ones given for each problem. Write the best answer in the blank at the side.

    A. A piece of aluminum has a mass of about 169 grams. A length of lead pipe has a mass of 870 grams. Estimate the difference between the masses of the two objects.

    (a) 600 grams (b) 700 grams (c) 800 grams (d) 80 grams ________

    B. There are 1 759 bricks in a pile, 1 761 bricks in a second pile, and 1 763 bricks in a third pile. About how many bricks are there in all three piles?

    (a) 5 000 (b) 7 000 (c) 3 000 (d) 11 000 ________

16 Solve the following problem in the space below. Write your final answer on the blank provided.

Sugar costs $21.60 a bag. Flour costs $8.36 a bag less than sugar. How much do 5 bags of flour cost?

____

17 Solve the following problem in the space below. Write your final answer on the blank provided.

There are 4 126 boxes of books to haul. Each truck can haul 28 boxes. How many trucks are needed to haul the books.

____

ANALYSIS

```
 _ZONE_ONE__PUPILS_IN_1978_AND_1979_ACHIEVING_WITHIN_EACH_CATAGCRY_A-D_
     CRITERION CATEGORIES FOR     GRADE:5   STRAND:2   OBJECTIVE: 6
          TOTAL NUMBER OF PUPILS:  1978 N=2129    1979 N=1862

            A: BELOW 50%      B:  50-64%       C:  65-84%        D: 85-100%
        ____1978___1979____1978___1979_____1978___1979_____1978___1979_
NUMBER(%)  70.22   66.70    15.64   15.90      7.89    9.94      6.25    7.47
MEAN (%)   20.75   20.63    57.31   57.85     73.62   73.94     89.82   91.34

          TABLES COMPARING 1978 AND 1979 MEAN SCORES AND PROPORTIONS
   ___PROPORTION TEST___ #  ___________________F-TEST____________________
   HO: PRCPOR78=PROPOR79 #  ________SS________  ______DF______
   _T-CALC___DF___PROB_#__BETWEEN_____WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
A:   2.389  3989   0.017 #     10.24  620944.24    1       2735    0.045  0.832
B:  -0.221  3989   0.825 #     45.74   17352.95    1        627    1.653  0.199
C:  -2.269  3989   0.023 #      9.02    2659.44    1        351    1.190  0.276
D:  -1.523  3989   0.128 #    156.71   10088.64    1        270    4.194  0.042


   _____COMPARING_THE_MEAN_SCORES_OF_PUPILS_WITHIN_ZONE_SUBGROUPS______
                                 __________________F-TEST TABLE________________
GROUPS        YEARS        #  ________SS________  ______DF______
======_____1978___1979_#__BETWEEN_____WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
EARLY       33.23    35.47 #   3227.41 1857493.62    1      2598    4.514  0.034
LATE        39.06    39.35 #     26.05  891021.69    1      1268    0.037  0.847
MALE        33.80    36.59 #   3938.72 1466006.99    1      2030    5.454  0.020
FEMALE      36.16    37.68 #   1129.72 1425325.75    1      1957    1.551  0.213
NORTH       30.75    31.58 #    244.39 1015782.14    1      1439    0.346  0.556
SOUTH       37.36    40.22 #   8182.71 1825507.78    1      2548    7.234  0.007
PUBLIC      34.91    37.21 #   4357.70 2418014.32    1      3290    5.937  0.015
SEPARATE    35.21    36.71 #    391.42  479732.44    1       697    0.569  0.461
```

FIGURE 135

LEVEL E (Grade 5)

OPERATIONS AND PROPERTIES

OBJECTIVE 7 *Adds, subtracts and multiplies decimals to thousandths.*

TEST ITEMS

18. Multiply the following:

(a) 0.5 × 0.7   (b) 0.25 × 3.2   (c) 427.8 × 2.61 =

19. Add the following:

(a) 0.05 + 1.96   (b) 19.243 + 6.351   (c) 11.040 + 7.591 =

20. Subtract the following:

(a) 1.9 − 0.7   (b) 8.63 − 7.29 =   (c) 4.844 − 0.369

ANALYSIS

```
 _ZONE_ONE__PUPILS_IN_1978_AND_1979_ACHIEVING_WITHIN_EACH_CATAGORY_A-D_
     CRITERION CATEGORIES FOR     GRADE:5   STRAND:2   OBJECTIVE: 7
           TOTAL NUMBER OF PUPILS:  1978 N=2129    1979 N=1862

          A: BELOW 50%       B:  50-64%         C:  65-84%          D: 85-100%
      ____1978____1979_____1978____1979_____1978____1979_____1978____1979_
NUMBER(%)  41.15   32.87     15.36   14.82     30.91   33.30     12.59   19.01
MEAN (%)   23.69   24.75     55.64   55.58     71.18   71.53     91.85   92.05

           TABLES COMPARING 1978 AND 1979 MEAN SCORES AND PROPORTIONS
   ___PROPORTION TEST___ #  ____________________F-TEST____________________
   HO: PROPOR78=PROPOR79 #  ________SS________  ______DF______
   _T-CALC___DF____PROB_#_BETWEEN_____WITHIN_BETWEEN_WITHIN__F-RATIO__PROB
A:    5.395  3989   0.000 #    403.76  442648.29    1       1486     1.355  0.245
B:    0.472  3989   0.637 #      0.63     553.08    1        601     0.683  0.409
C:   -1.615  3989   0.107 #     40.68   38458.93    1       1276     1.350  0.246
D:   -5.582  3989   0.000 #      8.58   15343.78    1        620     0.347  0.556

   ______COMPARING_THE_MEAN_SCORES_OF_PUPILS_WITHIN_ZONE_SUBGROUPS______
                                   ____________________F-TEST TABLE_________________
GROUPS         YEARS         #  ________SS________  ______DF______
======______1978____1979__#__BETWEEN______WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
EARLY        49.53    57.14 #  37319.86 2098333.09    1       2598    46.207  0.000
LATE         56.85    58.32 #    680.44  859548.51    1       1268     1.004  0.317
MALE         48.22    55.01 #  23345.25 1601346.05    1       2030    29.594  0.000
FEMALE       55.61    60.50 #  11642.19 1429867.88    1       1957    15.934  0.000
NORTH        45.00    54.11 #  29680.69 1262121.86    1       1439    33.840  0.000
SOUTH        55.76    59.70 #   9846.36 1741705.33    1       2548    14.405  0.000
PUBLIC       52.25    57.02 #  18631.88 2551449.15    1       3290    24.025  0.000
SEPARATE     49.97    60.86 #  20654.51  517231.71    1        697    27.833  0.000
```

FIGURE 136

performances in adding, subtracting and multiplying decimals to thousandths. Even so, only a little over fifty percent of the pupils were above a percentage mean of 65 (categories C and D.

MEASUREMENT (Ten objectives; Figures 37 to 146)

Hypothesis 1

One objective had performances where eighty percent of the Zone One pupils in 1978 and 1979 were in the 85-100 percent achievement category.

Hypothesis 2

Seven objectives had significant increases in the proportion of pupils reaching the 85-100 percent criterion category from 1978 to 1979.

Findings

About two-thirds of the grade five pupils could read and write time to seconds in at least three out of four examples provided. The same proportion of pupils could read the 24 hour clock with reasonable accuracy.

Drawing 2-dimensional figures to scale was introduced in grade five, however, one-third of the grade five pupils could not calculate scale, at least for the example using 0.5 cm=1 m .

Area and volume concepts were not handled well by the students. About forty percent of the pupils did not know how to compute either.

Eighty-seven percent of the 1979 test group received

LEVEL E (Grade 5)

MEASUREMENT

OBJECTIVE 1 *Extends use of standard units to include tonnes.*

TEST ITEMS

1. In the blank, write the number of the item which would be approximately 2 m in length.

   (1) a baseball bat

   (2) a truck

   (3) a house

   (4) a bed ________

2. King Kong can lift 10 Volkswagens with one hand. How great a mass is he lifting? Write the number in the blank.

   (1) one tonne (2) 10 grams (3) 40 kilograms (4) 10 tonnes ________

ANALYSIS

```
 _ZONE_ONE__PUPILS_IN_1978_AND_1979_ACHIEVING_WITHIN_EACH_CATAGORY_A-D_
    CRITERION CATEGORIES FOR    GRADE:5   STRAND:3   OBJECTIVE: 1
         TOTAL NUMBER OF PUPILS:  1978 N=2129    1979 N=1862

              A: BELOW 50%      B:  50-64%        C:  65-84%         D: 85-100%
                                                                   _1978____1979_
           ____1978____1979_____1978____1979_____1978____1979_____  47.53   47.64
NUMBER(%)   13.95     12.57     38.52    39.80     0.0      0.0      100.00  100.00
MEAN (%)     0.0       0.0      50.00    50.00    ******   ******

          TABLES COMPARING 1978 AND 1979 MEAN SCORES AND PROPORTIONS
   ___PROPORTION TEST___ #  _____________________F-TEST_____________________
   HO: PROPOR78=PROPOR79 #  ________SS________  ______DF______
   _T-CALC___DF___PROB_#_ BETWEEN____WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
A:    1.283  3989   0.200 #  <<<<<<<<<<<<<< SSW IS EQUAL TO ZERO >>>>>>>>>>>>>>
B:   -0.827  3989   0.409 #  <<<<<<<<<<<<<< SSW IS EQUAL TO ZERO >>>>>>>>>>>>>>
C:    0.0    3989   1.000 #  <<<<<<<<< TOO FEW PUPILS FOR CALCULATICNS >>>>>>>>
D:   -0.065  3989   0.948 #  <<<<<<<<<<<<<< SSW IS EQUAL TO ZERO >>>>>>>>>>>>>>

       _____COMPARING_THE_MEAN_SCORES_OF_PUPILS_WITHIN_ZONE_SUBGROUPS______
                          _____________________F-TEST TABLE_________________
                              ________SS________  ______DF______
GROUPS        YEARS       #  ________SS________  ______DF______
======_____1978____1979__#__BETWEEN____WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
                                                       2598     0.507   0.477
EARLY       65.34    66.34 #    648.16 3323735.50   1     1268     0.005   0.946
LATE        69.94    70.07 #      5.06 1391994.94   1     2030     0.132   0.717
MALE        69.04    68.47 #    161.56 2486087.21   1     1957     1.729   0.189
FEMALE      64.47    66.56 #   2123.22 2403269.84   1     1439     1.450   0.229
NORTH       62.21    64.54 #   1950.70 1936057.63   1     2548     0.023   0.879
SOUTH       69.41    69.21 #     26.57 2931272.45   1     3250     0.445   0.505
PUBLIC      67.07    66.25 #    551.54 4074724.13   1      697     9.655   0.002
SEPARATE    65.45    73.48 #  11254.50  812443.64   1
```

FIGURE 137

LEVEL E (Grade 5)

MEASUREMENT

OBJECTIVE 2 *Reads and writes time to seconds.*

TEST ITEMS

3. Write the number of the best answer on the blank.

(A) 5 minutes to 11 is written

(1) 11 05 (2) 5 2 11 (3) 10 55 A. ____________

(B) 13 minutes past four is written

(1) 13 04 (2) 40 13 (3) 4 13 B. ____________

(C) 6 minutes 3 seconds is written

(1) 6:3 (2) 6:03 (3) 6:30 C. ____________

(D) 3 hours, 17 minutes, 19 seconds is written

(1) 19:17:3 (2) 3:19:17 (3) 3:17:19 D. ____________

ANALYSIS

```
 _ZONE_ONE__PUPILS_IN_1978_AND_1979_ACHIEVING_WITHIN_EACH_CATAGCRY_A-D_
     CRITERION CATEGCRIES FOR     GRADE:5   STRAND:3   OBJECTIVE: 2
          TOTAL NUMBER OF PUPILS:  1978 N=2129    1979 N=1862

          A: BELOW 50%       B:  50-64%        C:  65-84%        D: 85-100%
      ____1978____1979_____1978____1979_____1978____1979_____1978____1979_
NUMBER(%)  15.64    12.62     24.05    22.77     34.05    33.89     26.26    30.72
MEAN (%)   16.89    17.55     50.00    50.00     75.00    75.00    100.00   100.00

          TABLES COMPARING 1978 AND 1979 MEAN SCORES AND PROPORTIONS
   ___PROPORTION TEST___ #  ____________________F-TEST____________________
   HO: PRCPOR78=PROPOR79 #  _________SS________  ______DF______
   _T-CALC____DF____PROB_#__BETWEEN_____WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
A:    2.725  3989   0.007 #     60.25   76326.19     1       566     0.447  0.504
B:    0.950  3989   0.342 #  <<<<<<<<<<<<<< SSW IS EQUAL TO ZERO >>>>>>>>>>>>>>
C:    0.110  3989   0.913 #  <<<<<<<<<<<<<< SSW IS EQUAL TO ZERO >>>>>>>>>>>>>>
D:   -3.121  3989   0.002 #  <<<<<<<<<<<<<< SSW IS EQUAL TO ZERO >>>>>>>>>>>>>>


   _____COMPARING_THE_MEAN_SCORES_OF_PUPILS_WITHIN_ZONE_SUBGROUPS______
                            ___________________F-TEST TABLE_________________
GROUPS         YEARS     #  _________SS________  ______DF______
======_____1978____1979__#__BETWEEN_____WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
EARLY       63.94   68.86 #  15588.47 2128449.99     1      2598    19.027  0.000
LATE        72.01   71.08 #    273.17  787327.22     1      1268     0.440  0.507
MALE        66.04   69.74 #   6931.62 1672974.88     1      2030     8.411  0.004
FEMALE      66.91   69.74 #   3907.59 1388010.48     1      1957     5.509  0.019
NORTH       60.17   63.01 #   2872.50 1262049.43     1      1439     3.275  0.071
SOUTH       70.06   73.49 #   7507.12 1704159.55     1      2548    11.224  0.001
PUBLIC      66.25   69.50 #   8654.71 2542043.00     1      3290    11.201  0.001
SEPARATE    67.48   70.83 #   1959.30  518401.93     1       697     2.634  0.105
```

FIGURE 138

LEVEL E (Grade 5)

MEASUREMENT

OBJECTIVE 3 *Reads the 24 hour clock.*

TEST ITEMS

4. Write the number of the best answer on the blank.

A. On a 24 hour clock, 0900 would be

(1) 9:00 a.m. (2) 9:00 p.m. (3) 12:09 p.m. A. ____________

B. If the same clock read 1500, the time would be

(1) 12:15 p.m. (2) 3:00 a.m. (3) 3:00 p.m. B. ____________

C. 2400 would be

(1) 12:00 noon (2) 12:00 midnight (3) none of these C. ____________

ANALYSIS

```
 ZONE ONE  PUPILS IN 1978 AND 1979 ACHIEVING WITHIN EACH CATAGCRY A-D
      CRITERION CATEGORIES FOR     GRADE:5    STRAND:3    OBJECTIVE: 3
            TOTAL NUMBER OF PUPILS:  1978 N=2129     1979 N=1862

                                                        
            A: BELOW 50%        B:  50-64%          C:  65-84%        D: 85-100%
          ____1978____1979______1978____1979_____1978____1979______1978____1979_
NUMBER(%)   39.69     36.09      0.0      0.0      25.65   27.18     34.66    36.73
MEAN (%)    20.36     19.44    ******   ******     66.67   66.67    100.00   100.00

          TABLES COMPARING 1976 AND 1979 MEAN SCORES AND PROPORTIONS
   ___PROPORTION TEST___ #  ___________________F-TEST_____________________
   HO: PRCPOR78=PROPOR79 #  ________SS________  ______DF______
    T-CALC    DF    PROB #  BETWEEN      WITHIN  BETWEEN WITHIN   F-RATIO  PROB
A:    2.337  3989  0.019 #    310.37  404708.31     1      1515     1.162   0.281
B:    0.0    3989  1.000 #  <<<<<<<< TOO FEW PUPILS FOR CALCULATICNS >>>>>>>>
C:   -1.094  3589  0.274 #  <<<<<<<<<<<<< SSW IS EQUAL TO ZERO >>>>>>>>>>>>>>
D:   -1.363  3989  0.174 #  <<<<<<<<<<<<< SSW IS EQUAL TO ZERO >>>>>>>>>>>>>>

        COMPARING THE MEAN SCORES OF PUPILS WITHIN ZONE SUBGROUPS______
     ______________________________________F-TEST TABLE__________________
                              ____________________
                          #  ________SS________  ______DF______
GROUPS        YEARS       #  BETWEEN      WITHIN  BETWEEN WITHIN   F-RATIO  PROB
======_____1978____1979_  #  5775.65 3476425.63     1      2598     4.316   0.038
EARLY       57.07   60.07 #   389.38 1455436.51     1      1268     0.339   0.560
LATE        66.37   65.26 #   366.50 2628408.65     1      2030     0.283   0.595
MALE        60.17   61.02 #  5156.36 2523437.60     1      1957     3.999   0.046
FEMALE      59.50   62.76 #  1091.88 1959959.86     1      1439     0.802   0.371
NORTH       52.63   54.37 #  2779.97 3071850.10     1      2548     2.306   0.129
SOUTH       63.96   66.05 #  8537.41 4233682.11     1      3290     6.634   0.010
PUBLIC      59.41   62.64 #  2252.85  912790.86     1       697     1.720   0.190
SEPARATE    61.88   58.28 #
```

FIGURE 139

LEVEL E (Grade 5)

MEASUREMENT

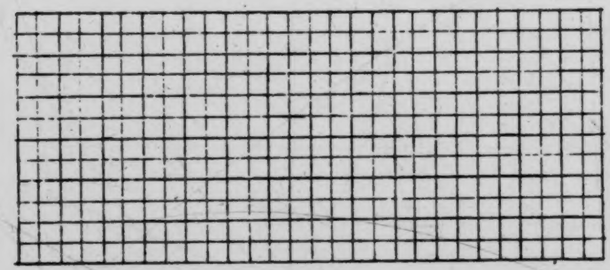
OBJECTIVE 4 *Draws 2-D figures to scale using grid paper.*

TEST ITEMS

5. On the graph paper, draw the following to scale (0.5 cm = 1 m).

(A) Draw a square with side 3 m long

(B) Draw a rectangle 5 m X 8 m



ANALYSIS

```
 ZONE ONE  PUPILS IN 1978 AND 1979 ACHIEVING WITHIN EACH CATAGORY A-D
     CRITERION CATEGORIES FOR     GRADE:5   STRAND:3   OBJECTIVE: 4
          TOTAL NUMBER OF PUPILS:  1978 N=2129    1979 N=1862

            A: BELOW 50%       B:  50-64%        C:  65-84%        D: 85-100%
           1978    1979      1978    1979      1978    1979      1978    1979
NUMBER(%)  44.72   33.19     13.39   14.93     0.47    0.43      41.43   51.45
MEAN (%)   0.08    0.04      50.00   50.00     75.00   75.00     100.00  100.00

          TABLES COMPARING 1978 AND 1979 MEAN SCORES AND PROPORTIONS
   ___PROPORTION TEST___ #  ___________________F-TEST_____________________
   HO: PROPOR78=PROPOR79 #  ________SS________  ______DF______
    T-CALC    DF    PROB #  BETWEEN      WITHIN  BETWEEN WITHIN  F-RATIO  PROB
A:   7.436  3989   0.000 #     0.55     2493.08     1     1568    0.346  0.556
B:  -1.398  3989   0.163 #  <<<<<<<<<<<<<< SSW IS EQUAL TO ZERO >>>>>>>>>>>>>>
C:   0.188  3989   0.851 #  <<<<<<<<<<<<<< SSW IS EQUAL TO ZERO >>>>>>>>>>>>>>
D:  -6.337  3989   0.000 #  <<<<<<<<<<<<<< SSW IS EQUAL TO ZERO >>>>>>>>>>>>>>

     ______COMPARING THE MEAN SCORES OF PUPILS WITHIN ZONE SUBGROUPS______
                            __________________F-TEST TABLE________________
GROUPS        YEARS      #  ________SS________  ______DF______
======     1978    1979  #  BETWEEN     WITHIN  BETWEEN WITHIN  F-RATIO  PROB
EARLY      47.09   57.91 #  75359.11 5461413.72    1     2598    35.848  0.000
LATE       52.33   60.12 #  19190.81 2661252.59    1     1268     9.144  0.003
MALE       48.27   60.76 #  78990.23 4197947.52    1     2030    38.197  0.000
FEMALE     48.76   57.68 #  38757.21 4162157.79    1     1957    18.223  0.000
NORTH      43.96   55.62 #  48726.68 3050054.55    1     1439    22.989  0.000
SOUTH      51.11   61.28 #  65665.22 5275768.35    1     2548    31.714  0.000
PUBLIC     47.56   58.94 # 106177.91 6933231.26    1     3290    50.384  0.000
SEPARATE   53.05   60.68 #  10149.81 1421416.71    1      657     4.977  0.026
```

FIGURE 140

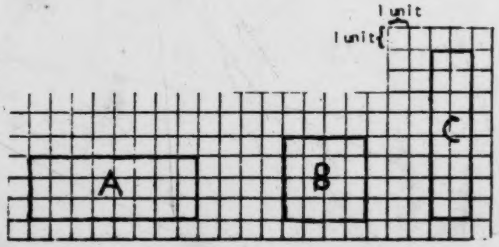
LEVEL E (Grade 5)

MEASUREMENT

OBJECTIVE 5 *Finds area of regular polygons without using formulae.*

TEST ITEMS

6. Find the area of rectangles A, B, and C.
Write the area on the blanks at the side.



A. ____________
B. ____________
C. ____________

ANALYSIS

```
 _ZONE ONE  PUPILS IN 1978 AND 1979 ACHIEVING WITHIN EACH CATAGCRY A-D_
      CRITERION CATEGCRIES FOR     GRADE:5   STRAND:3   OBJECTIVE: 5
          TOTAL NUMBER OF PUPILS:  1978 N=2129    1979 N=1862

          A: BELOW 50X       B:  50-64X        C:  65-84X        D: 85-100X
       ____1978____1979_____1978____1979_____1978____1979_____1978____1979_
NUMBER(X)  49.22    40.33      0.0      0.0     27.24   30.24    23.53   29.43
MEAN (X)    3.69     5.28   ******   ******     66.67   66.67   100.00  100.00

           TABLES COMPARING 1978 AND 1979 MEAN SCORES AND PROPORTIONS
   ___PROPORTION TEST___ #  ___________________F-TEST_____________________
   HO: PROPOR78=PROPOR79 #  ________SS________  ______DF______
   _T-CALC    DF    PROB #  BETWEEN      WITHIN  BETWEEN WITHIN  F-RATIO  PROB
A:   5.632  3989   0.000 #   1109.20  225893.46    1      1797    8.824  0.003
B:   0.0    3989   1.000 #  <<<<<<<<< TOO FEW PUPILS FOR CALCULATICNS >>>>>>>>
C:  -2.087  3989   0.037 #  <<<<<<<<<<<<<< SSW IS EQUAL TO ZERO >>>>>>>>>>>>>>
D:  -4.223  3989   0.000 #  <<<<<<<<<<<<<< SSW IS EQUAL TC ZERO >>>>>>>>>>>>>>


   _____COMPARING THE MEAN SCORES OF PUPILS WITHIN ZONE SUBGROUPS______
                            ___________________F-TEST TABLE__________________
GROUPS       YEARS       #  ________SS________  ______DF______
======_____1978____1979__#__BETWEEN_____WITHIN__BETWEEN WITHIN__F-RATIO__PROB
EARLY      41.97   49.29 #  34480.01 4402887.08    1      2598   20.346  0.000
LATE       46.77   55.71 #  25210.87 2175321.94    1      1268   14.695  0.000
MALE       41.22   50.91 #  47520.66 3402465.67    1      2030   28.352  0.000
FEMALE     45.88   52.56 #  21758.96 3404844.18    1      1957   12.506  0.001
NORTH      43.15   48.43 #   9962.61 2520110.64    1      1439    5.689  0.017
SOUTH      43.71   53.56 #  61506.41 4288576.82    1      2548   36.543  0.000
PUBLIC     43.39   50.70 #  43720.34 5581251.64    1      3290   25.772  0.000
SEPARATE   44.08   56.46 #  26706.22 1229679.09    1       697   15.137  0.000
```

FIGURE 141

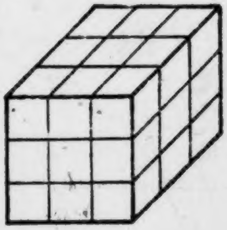
LEVEL E (Grade 5)

MEASUREMENT

OBJECTIVE 6 *Finds volume of rectangular solids without using formulae.*

TEST ITEMS

7. What is the volume of the following figure? Each cube is 1 cm^3. Write your answer on the blank.



Volume = ___________

ANALYSIS

```
 ZONE ONE  PUPILS IN 1978 AND 1979 ACHIEVING WITHIN EACH CATAGORY A-D
      CRITERION CATEGORIES FOR     GRADE:5   STRAND:3   OBJECTIVE: 6
              TOTAL NUMBER OF PUPILS:  1978 N=2129    1979 N=1862

             A: BELOW 50%       B:  50-64%        C:  65-84%        D: 85-100%
           ____1978___1979_____1978___1979_____1978____1979_____1978____1979_
NUMBER(%)   43.21    36.41      29.97   32.38     0.0      0.0      26.82   31.20
MEAN (%)     0.0      0.0       50.00   50.00    ******  ******    100.00  100.00

             TABLES COMPARING 1978 AND 1979 MEAN SCORES AND PROPORTIONS
   ___PROPORTION TEST___ #  ____________________F-TEST______________________
   HO: PRCPOR78=PROPOR79 #  ________SS________  ______DF______
   _T-CALC____DF____PROB_#__BETWEEN_____WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
A:   4.374   3989   0.000 #  <<<<<<<<<<<<<< SSW IS EQUAL TO ZERO >>>>>>>>>>>>>>
B:  -1.646   3989   0.100 #  <<<<<<<<<<<<<< SSW IS EQUAL TO ZERO >>>>>>>>>>>>>>
C:   0.0     3989   1.000 #  <<<<<<<< TOO FEW PUPILS FOR CALCULATIONS >>>>>>>>
D:  -3.048   3989   0.002 #  <<<<<<<<<<<<<< SSW IS EQUAL TO ZERO >>>>>>>>>>>>>>


   _____COMPARING THE MEAN SCORES OF PUPILS WITHIN ZONE SUBGROUPS_______
                                ____________________F-TEST TABLE__________________
GROUPS          YEARS       #   ________SS________  ______DF______
======______1978____1979__#__BETWEEN______WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
EARLY       40.79   45.86 #   16549.20 4323835.42     1       2598     9.944   0.002
LATE        44.53   49.58 #    8041.53 2157173.04     1       1268     4.727   0.030
MALE        39.56   47.26 #   30045.07 3334871.27     1       2030    18.289   0.000
FEMALE      44.13   47.53 #    5657.25 3373324.37     1       1957     3.282   0.070
NORTH       37.02   43.85 #   16749.67 2341803.42     1       1439    10.292   0.001
SOUTH       44.54   49.37 #   14835.96 4336616.00     1       2548     8.717   0.003
PUBLIC      40.71   46.54 #   27841.00 5427276.71     1       3290    16.877   0.000
SEPARATE    47.02   51.36 #    3288.33 1273607.23     1        697     1.800   0.180
```

FIGURE 142

LEVEL E (Grade 5)

MEASUREMENT

OBJECTIVE 7 *Uses appropriate standardized measuring units.*

TEST ITEMS

8. What standard metric units would you use to measure the length of the following:

(1) a math book ____________ (4) a Kenworth truck ____________

(2) a kitchen table ____________ (5) Peace River to Edmonton ____________

(3) a living room ____________ (6) pencil ____________

9. List the units below under the correct headings. Write the names of the units on the blanks. You do not have to fill every blank.

1. metre
2. ℓitre
3. decilitre
4. kilometre
5. millilitre
6. centilitre
7. kilogram
8. centimetre
9. decagram
10. gram
11. millimetre
12. milligram

weight	length	capacity
____________	____________	____________
____________	____________	____________
____________	____________	____________
____________	____________	____________

ANALYSIS

```
    ZONE ONE  PUPILS IN 1978 AND 1979 ACHIEVING WITHIN EACH CATAGCRY A-D
       CRITERION CATEGORIES FOR     GRADE:5   STRAND:3   OBJECTIVE: 7
            TOTAL NUMBER OF PUPILS:  1978 N=2129    1979 N=1862

            A: BELOW 50%       B:  50-64%        C:  65-84%        D: 85-100%
              1978    1979     1978    1979      1978    1979      1978    1979
NUMBER(%)   20.20   16.33      9.82    8.54     10.94    9.61     59.04   65.52
MEAN (%)    21.86   24.25     57.14   57.14     71.43   71.43     94.95   95.54

              TABLES COMPARING 1978 AND 1979 MEAN SCORES AND PROPORTIONS
   ___PROPORTION TEST___ #  ____________________F-TEST______________________
   HO: PRCPOR78=PROPOR79 #  _________SS________  ______DF______
    T-CALC    DF    PROB #  BETWEEN      WITHIN  BETWEEN WITHIN  F-RATIO  PROB
A:   3.149  3989   0.002 #  1015.29  223523.44     1       732    3.325  0.069
B:   1.392  3989   0.165 # <<<<<<<<<<<<<< SSW IS EQUAL TO ZERO >>>>>>>>>>>>>>>
C:   1.378  3989   0.168 #      0.0       0.00     1       410    0.0    1.000
D:  -4.208  3989   0.000 #   211.64  112078.58     1      2475    4.674  0.031


   _____COMPARING THE MEAN SCORES OF PUPILS WITHIN ZONE SUBGROUPS______
                            ___________________F-TEST TABLE__________________
GROUPS        YEARS      #  _________SS________  ______DF______
======        1978   1979 #  BETWEEN      WITHIN  BETWEEN WITHIN  F-RATIO  PROB
EARLY        71.71  76.24 # 13236.19 2393331.40     1      2598   14.368  0.000
LATE         79.09  82.61 #  3912.71  879041.01     1      1268    5.644  0.018
MALE         73.94  79.26 # 14349.28 1839981.32     1      2030   15.831  0.000
FEMALE       73.87  77.30 #  5740.21 1605959.85     1      1957    6.995  0.008
NORTH        65.17  71.11 # 12622.34 1572078.76     1      1439   11.554  0.001
SOUTH        78.89  82.32 #  7454.04 1729095.70     1      2548   10.984  0.001
PUBLIC       74.70  78.13 #  9655.65 2839649.03     1      3290   11.187  0.001
SEPARATE     70.11  79.09 # 14043.78  601414.46     1       697   16.276  0.000
```

FIGURE 143

LEVEL E (Grade 5)

MEASUREMENT

OBJECTIVE 8 *Understands the system of metric prefixes, including use of symbols.*

kilo hecto deca Basic Unit deci centi milli

TEST ITEMS

10. Give the value of the following prefixes; e.g., hundred, tens, tenths. Write the prefix symbol.

	Value	Symbol
(1) kilo -		
(2) deci -		
(3) milli -		
(4) hecto -		
(5) centi -		
(6) deca -		

ANALYSIS

```
_ZONE_ONE__PUPILS_IN_1978_AND_1979_ACHIEVING_WITHIN_EACH_CATAGORY_A-D_
     CRITERION CATEGORIES FOR    GRADE:5   STRAND:3   OBJECTIVE: 8
          TOTAL NUMBER OF PUPILS:  1978 N=2129    1979 N=1862

                                                             D: 85-100%
          A: BELOW 50%       B:  50-64%        C:  65-84%   _1978___1979_
      ____1978____1979____1978____1979____1978___1979____    17.94   21.97
NUMBER(%)  45.70    38.94    15.74    17.35    20.62   21.75    100.00  100.00
MEAN (%)    8.27     8.64    50.00    50.00    73.88   74.32

          TABLES COMPARING 1978 AND 1979 MEAN SCORES AND PROPORTIONS
   ___PROPORTION TEST___ #  ____________________F-TEST____________________
   HO: PROPOR78=PROPOR79 #  _________SS________  ______DF______
   _T-CALC____DF___PROB_#__BETWEEN_____WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
A:   4.313   3989   0.000 #     56.97  257843.34    1      1696     0.375  0.541
B:  -1.369   3989   0.171 #  <<<<<<<<<<<<<< SSW IS EQUAL TO ZERO >>>>>>>>>>>>>>
C:  -0.873   3989   0.383 #     40.96   57873.73    1       842     0.596  0.440
D:  -3.181   3989   0.002 #  <<<<<<<<<<<<<< SSW IS EQUAL TO ZERO >>>>>>>>>>>>>>


     ______COMPARING_THE_MEAN_SCORES_OF_PUPILS_WITHIN_ZONE_SUBGROUPS______
   _________________________________F-TEST TABLE___________________
                              ____________________
GROUPS         YEARS      #  _________SS________  ______DF______
======______1978____1979__#__BETWEEN_____WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
EARLY         42.27   49.08 #  29782.81 3655139.30    1      2598    21.169  0.000
LATE          50.74   51.55 #    206.00 1787935.95    1      1268     0.146  0.702
MALE          40.82   47.68 #  23838.31 2803712.00    1      2030    17.260  0.000
FEMALE        48.97   52.76 #   7016.96 2809156.55    1      1957     4.888  0.027
NORTH         40.46   43.78 #   3942.51 2064303.69    1      1439     2.748  0.098
SOUTH         47.32   53.74 #  26165.68 3530228.66    1      2548    18.885  0.000
PUBLIC        44.66   49.08 #  15973.77 4741540.99    1      3290    11.084  0.001
SEPARATE      45.62   55.25 #  16167.86  907979.33    1       657    12.411  0.000
```

FIGURE 144

LEVEL E (Grade 5)

MEASUREMENT

OBJECTIVE 9

Expresses equivalent measures within units of length, mass and capacity.

e.g. 1 m + 4 dm + 2 cm = 1.42 m, 14.2 dm, or 142 cm

TEST ITEMS

11. A barrel of gas has a capacity of 190 litres.

This is ____________ millilitres.

12. Wolfman Jack has 3 467 kilograms of cobwebs in his house.

This is ____________ grams.

This is ____________ tonnes.

13. Jane walks 3 000 millimetres from her desk to her book shelf.

She walks ____________ metres.

She walks ____________ centimetres.

She walks ____________ decimetres.

She walks ____________ kilometres.

ANALYSIS

```
 ZONE ONE  PUPILS IN 1978 AND 1979 ACHIEVING WITHIN EACH CATAGCRY A-D
     CRITERION CATEGORIES FOR    GRADE:5   STRAND:3   OBJECTIVE: 9
          TOTAL NUMBER OF PUPILS:  1978 N=2129    1979 N=1862

           A: BELOW 50%       B:  50-64%       C:  65-84%        D: 85-100%
          1978     1979     1978     1979     1978     1979     1978     1979
NUMBER(%)  77.31    73.04     8.17     9.08     5.78     7.04     8.74    10.85
MEAN (%)   13.35    15.88    57.14    57.14    71.43    71.43    92.24    92.72

          TABLES CCMPARING 1978 AND 1979 MEAN SCORES AND PROPORTIONS
    ___PROPORTION TEST___ #  ____________________F-TEST____________________
    HO: PRCPOR78=PROPOR79 #  ________SS________  ______DF______
     T-CALC    DF    PROB #  BETWEEN    WITHIN  BETWEEN WITHIN  F-RATIO  PROB
                                                         3004   17.018  0.000
A:    3.124  3989   0.002 #  4781.73  844066.43     1     341   48.714  0.000
B:   -1.016  3989   0.310 #     0.00       0.00     1     252    7.200  0.008
C:   -1.624  3989   0.105 #     0.00       0.00     1     386    0.424  0.515
D:   -2.247  3989   0.025 #    21.66   19721.66     1

         COMPARING THE MEAN SCORES OF PUPILS WITHIN ZONE SUBGROUPS
                                 ________________F-TEST TABLE_______________
                                 ________SS________   ______DF______
GROUPS        YEARS      #                                                     
======      1978    1979 #  BETWEEN     WITHIN    BETWEEN WITHIN  F-RATIO  PROB
                                                           2598   11.257  0.001
EARLY      25.52   29.51 # 10246.65  2364856.65     1      1268    6.323  0.012
LATE       31.06   35.49 #  6186.91  1240720.53     1      2030   14.502  0.000
MALE       27.49   32.74 # 13932.39  1950207.80     1      1957    8.880  0.003
FEMALE     26.85   30.97 #  8256.93  1819626.31     1      1439    2.019  0.156
NORTH      24.12   26.41 #  1870.46  1333401.24     1      2548   24.312  0.000
SOUTH      28.92   34.92 # 22859.34  2395764.42     1      3290   17.700  0.000
PUBLIC     27.48   32.03 # 16996.02  3159143.04     1       697    5.750  0.017
SEPARATE   25.75   31.13 #  8042.82  611[illegible]6.49     1
```

FIGURE 145

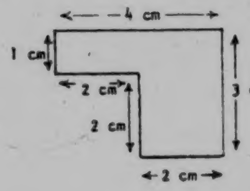
LEVEL E (Grade 5)

MEASUREMENT

OBJECTIVE 10 *Finds perimeter of polygons without using formulae.*

TEST ITEMS

14. Give the perimeter of the figure below by circling the correct answer.



(a) 14 cm (c) 10 cm
(b) 12 cm (d) 8 cm

ANALYSIS

```
 _ZONE_ONE__PUPILS_IN_1978_AND_1979_ACHIEVING_WITHIN_EACH_CATAGORY_A-D_
     CRITERION CATEGORIES FOR    GRADE:5   STRAND:3   OBJECTIVE:10
          TOTAL NUMBER OF PUPILS:  1978 N=2129   1979 N=1862

         A: BELOW 50%      B:  50-64%        C:  65-84%        D: 85-100%
       ____1978____1979_____1978____1979_____1978____1979_____1978____1979_
NUMBER(%)  17.99    11.98     0.05    0.11     0.05    0.05     81.92   87.86
MEAN (%)    0.0      0.22    50.00   50.00    75.00   75.00    100.00  100.00

            TABLES COMPARING 1978 AND 1979 MEAN SCORES AND PROPORTIONS
   ___PROPORTION TEST___ #  ____________________F-TEST______________________
   HO: PRCPOR78=PROPOR79 #  _________SS_________  ______DF______
   _T-CALC____DF____PROB_#__BETWEEN_____WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
A:    5.281   3989   0.000 #      7.09     1238.79     1      604     3.455  0.064
B:   -0.695   3989   0.487 # <<<<<<<<<<<<<< SSW IS EQUAL TC ZERO >>>>>>>>>>>>>>
C:   -0.095   3989   0.924 # <<<<<<<< TOO FEW PUPILS FOR CALCULATICNS >>>>>>>>
D:   -5.204   3989   0.000 # <<<<<<<<<<<<<< SSW IS EQUAL TC ZERO >>>>>>>>>>>>>>

     _____COMPARING_THE_MEAN_SCORES_OF_PUPILS_WITHIN_ZONE_SUBGROUPS_______
                            ____________________F-TEST TABLE__________________
GROUPS        YEARS         #  _________SS_________  ______DF______
======______1978____1979__#__BETWEEN_____WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
EARLY        80.62   85.71 #  16666.80 3656138.72      1      2596   11.843  0.001
LATE         85.08   92.28 #  16404.27 1279649.37      1      1268   16.255  0.000
MALE         80.08   87.26 #  26077.95 2772926.72      1      2030   19.091  0.000
FEMALE       83.93   88.73 #  11245.59 2317614.16      1      1957    9.496  0.002
NORTH        72.84   80.40 #  20483.56 2576319.88      1      1439   11.441  0.001
SOUTH        87.20   92.22 #  16014.77 2361716.60      1      2548   17.278  0.000
PUBLIC       82.74   86.90 #  14138.35 4242713.87      1      3290   10.964  0.001
SEPARATE     78.32   93.03 #  37698.07  840527.96      1       697   31.261  0.000
```

FIGURE 146

100 percent scores on the concept of perimeter.

Confusion in the Metric System still appears to exist. Although two-thirds of the students could identify the appropriate standardized measuring units for given measurement situations, less success was experienced in other objectives. Only one student in five showed complete understanding of the values assigned to the metric prefixes as well as the use of symbols.

Seventy percent of the grade five pupils could not express equivalent measures within units of length, mass and capacity. All but twelve percent of the pupils could choose a suitable referant for either or both the metre and the tonne.

GEOMETRY (Four objectives; Figures 147 to 150)

Hypothesis 1

None of the objectives had performances where eighty percent of the Zone One pupils in 1978 and 1979 were in the 85-100 percent criterion category.

Hypothesis 2

All four objectives had significant increases in the proportion of pupils achieving at the 85-100 percent level from 1978 to 1979.

Findings

The students in 1979 demonstrated better understanding of motion geometry than the 1978 group. Over three-quarters of the grade five's could test the congruency of polygons

LEVEL E (Grade 5)

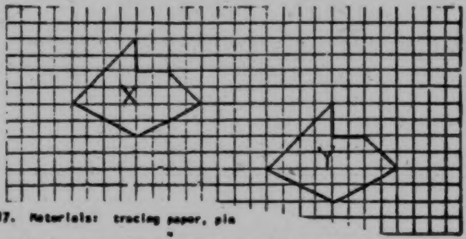
GEOMETRY

OBJECTIVE 1 *Tests congruency of polygons using motion geometry (slides, flips and turns).*

TEST ITEMS

15. Choose the best underlined answer and write it on the blank.

Polygon X is the <u>flip</u>, <u>slide</u>, <u>turn</u> image of Y. __________

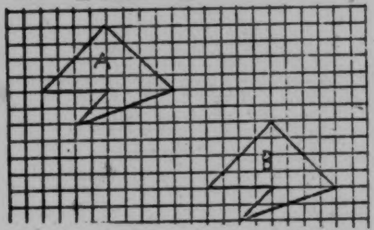


16. Materials: onion skin paper, pencil

Directions: Trace Polygon A to check if Polygon A and B are congruent.

Write the correct underlined answer on the blank.

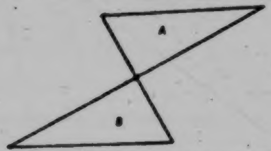
Polygon A <u>is</u>, <u>is not</u> congruent to Polygon B. __________



17. Materials: tracing paper, pin

Write the correct underlined answer on the blank.

Polygon A is the <u>flip</u>, <u>slide</u>, <u>turn</u> image of B.

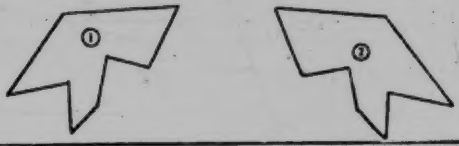


____

18. Materials: onion skin tracing paper, pencil, pin

Write the best answer on the blank.

Polygon ① is the <u>flip</u>, <u>slide</u>, <u>turn</u> image of ② ________



ANALYSIS

```
_ZONE_ONE__PUPILS_IN_1978_AND_1979_ACHIEVING_WITHIN_EACH_CATAGCRY_A-D_
     CRITERION CATEGORIES FOR    GRADE:5   STRAND:4   OBJECTIVE: 1
          TOTAL NUMBER OF PUPILS:  1978 N=2129   1979 N=1862

         A: BELOW 50%      B:  50-64%       C:  65-84%       D: 85-100%
     ____1978____1979_____1978____1979_____1978____1979_____1978____1979_
NUMBEP(%)  19.63   14.77      7.89    6.98     32.79   32.17     39.69   46.08
MEAN (%)   15.61   18.12     50.05   50.06     74.87   75.28     99.93   99.97

           TABLES CCMPARING 1978 AND 1979 MEAN SCORES AND PROPORTIONS
  ___PRCPORTION TEST___ #  ____________________F-TEST____________________
  HO: PRCPOR78=PROPOR79 #  ________SS________  ______DF______
  _T-CALC___DF____PROB_#__BETWEEN_____WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
A:   4.047  3989   0.000 #   1045.99  170687.62     1       691    4.234  0.040
B:   1.090  3989   0.276 #      0.02     137.94     1       296    0.033  0.856
C:   0.414  3989   0.679 #     54.08   89733.25     1      1255    0.780  0.377
D:  -4.071  3989   0.000 #      0.68     689.69     1      1701    1.671  0.196


  _____COMPARING_THE_MEAN_SCORES_OF_PUPILS_WITHIN_ZONE_SUBGROUPS______
                           ____________________F-TEST TABLE________________
GROUPS       YEARS       #  ________SS________  ______DF______
======_____1978____1979_#__BETWEEN_____WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
EARLY       69.72   75.15 #  19141.93 2593624.07     1      2598   19.174  0.000
LATE        74.57   79.15 #   6620.48 1099960.89     1      1268    7.632  0.006
MALE        69.62   76.52 #  24037.70 2058001.03     1      2030   23.711  C.000
FEMALE      72.87   76.39 #   6018.84 1773026.24     1      1957    6.643  0.010
NORTH       64.59   67.93 #   3996.21 1785040.33     1      1439    3.222  0.073
SOUTH       75.01   81.21 #  24417.60 1922545.94     1      2548   32.361  0.000
PUBLIC      71.71   75.81 #  13744.55 3166864.70     1      3290   14.279  0.000
SEPARATE    68.88   79.44 #  19443.23  663757.38     1       657   20.417  0.000
```

FIGURE 147

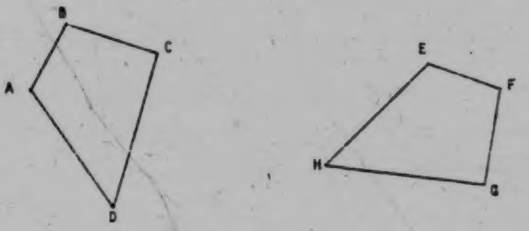
LEVEL E (Grade 5)

GEOMETRY

OBJECTIVE 2 *Names corresponding sides and angles of congruent polygons.*

TEST ITEMS

19. Name the corresponding sides and angles in the two congruent polygons.



Angle ____ corresponds to angle ____. Side ____ corresponds to side ____.

Angle ____ corresponds to angle ____. Side ____ corresponds to side ____.

Angle ____ corresponds to angle ____. Side ____ corresponds to side ____.

Angle ____ corresponds to angle ____. Side ____ corresponds to side ____.

ANALYSIS

```
  _ZONE_ONE__PUPILS_IN_1978_AND_1979_ACHIEVING_WITHIN_EACH_CATAGORY_A-D_
      CRITERION CATEGORIES FOR    GRADE:5   STRAND:4   CBJECTIVE: 2
          TOTAL NUMBER OF PUPILS:  1978 N=2129    1979 N=1862

           A: BELOW 50%      B:  50-64%       C:  65-84%        D: 85-100%
        ____1978____1979_____1978____1979_____1978____1979_____1978____1979_
NUMBER(%)  55.52   46.35    14.37   17.24     2.87    4.46    27.24   31.95
MEAN (%)    3.37    4.42    51.39   51.32    75.00   75.00    98.19   98.03

           TABLES COMPARING 1978 AND 1979 MEAN SCORES AND PROPORTIONS
   ___PROPORTION TEST___ #  ______________________F-TEST_____________________
   HO: PRCPOR78=PROPOR79 #  _________SS_________  ______DF______
   _T-CALC____DF____PROB_#__BETWEEN_____WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
A:    5.783  3989   0.000 #    543.89  196580.50    1      2043    5.652  0.018
B:   -2.483  3989   0.013 #      0.66    9472.03    1       625    0.044  0.835
C:   -2.691  3989   0.007 #  <<<<<<<<<<<<< SSW IS EQUAL TO ZERO >>>>>>>>>>>>>
D:   -3.258  3989   0.001 #      7.94   23591.26    1      1173    0.395  0.530


   ______COMPARING_THE_MEAN_SCORES_OF_PUPILS_WITHIN_ZONE_SUBGROUPS______
                              _____________________F-TEST TABLE________________
GROUPS        YEARS       #  _________SS_________  ______DF______
======______1978____1979__#__BETWEEN_____WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
EARLY        35.85   44.19 #  44791.07 4478992.34    1      2598   25.981  0.000
LATE         42.69   47.47 #   7229.15 2296262.97    1      1268    3.992  0.046
MALE         34.88   45.53 #  57362.28 3506201.87    1      2030   33.211  0.000
FEMALE       41.55   45.60 #   8007.03 3537695.98    1      1957    4.429  0.036
NORTH        37.68   40.14 #   2176.50 2529380.79    1      1439    1.238  0.266
SOUTH        38.43   48.59 #  65497.34 4507378.21    1      2548   37.025  0.000
PUBLIC       37.41   43.79 #  33297.49 5813265.92    1      3290   18.845  0.000
SEPARATE     41.70   53.79 #  25452.14 1221566.81    1       697   14.522  0.000
```

FIGURE 148

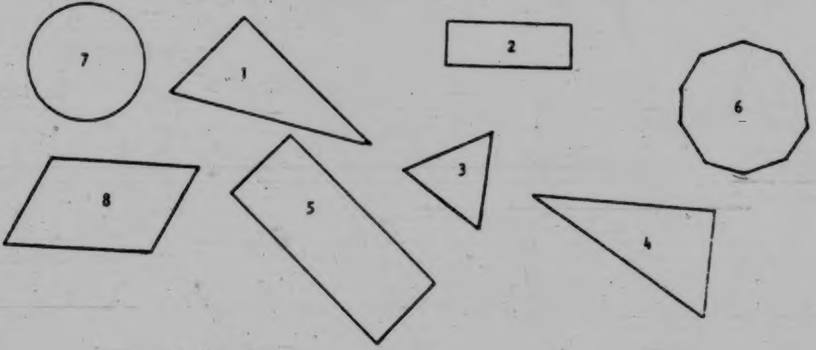
LEVEL E (Grade 5)

GEOMETRY

OBJECTIVE 3 *Distinguishes 2-dimensional figures as similar or congruent.*

TEST ITEMS

20. Look at the figures below. Fill in the blanks.



Figures ______ and ______ are congruent.

Figures ______ and ______ are similar.

ANALYSIS

```
_ZONE ONE__PUPILS IN 1978 AND 1979 ACHIEVING WITHIN EACH CATAGCRY A-D
     CRITERION CATEGORIES FOR     GRADE:5   STRAND:4   OBJECTIVE: 3
          TOTAL NUMBER OF PUPILS:  1978 N=2129   1979 N=1862

              A: BELOW 50%        B:  50-64%        C:  65-84%         D: 85-100%
          ____1978____1979_____1978____1979_____1978____1979_____1978____1979_
NUMBER(%)   19.49    13.96     34.57    30.02      0.14     0.11     45.80   55.91
MEAN (%)     1.60     1.35     50.00    50.00     75.00    75.00    100.00  100.00

           TABLES COMPARING 1978 AND 1979 MEAN SCORES AND PROPORTIONS
  ___PROPORTION TEST___ #  ____________________F-TEST_______________________
  HO: PRCPOR78=PROPOR79 #  ________SS________  ______DF______
  _T-CALC____DF____PROB_#__BETWEEN_____WITHIN__BETWEEN_WITHIN__F-RATIC__PROB
A:   4.649  3989   0.000 #     10.01   27377.49    1       673     0.246  0.620
B:   3.062  3989   0.002 # <<<<<<<<<<<<<< SSW IS EQUAL TO ZERO >>>>>>>>>>>>>>
C:   0.298  3989   0.765 # <<<<<<<<<<<<<< SSW IS EQUAL TO ZERO >>>>>>>>>>>>>>
D:  -6.374  3989   0.000 # <<<<<<<<<<<<<< SSW IS EQUAL TO ZERO >>>>>>>>>>>>>>

  ______COMPARING THE MEAN SCORES OF PUPILS WITHIN ZONE SUBGROUPS_______
GROUPS        YEARS       #  ___________________F-TEST TABLE__________________
                          #  ________SS________  ______DF______
======______1978____1979__#__BETWEEN_____WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
EARLY        62.34    69.27 #  30915.11 3676363.20    1     2598    21.847  0.000
LATE         67.08    73.63 #  13565.36 1566723.02    1     1268    10.979  0.001
MALE         60.86    70.17 #  43860.09 2900716.60    1     2030    30.694  0.000
FEMALE       66.22    72.25 #  17665.25 2516519.76    1     1957    13.738  0.000
NORTH        58.11    65.61 #  20172.27 2403609.39    1     1439    12.077  0.001
SOUTH        66.58    74.30 #  37860.80 2963291.16    1     2548    32.555  0.000
PUBLIC       64.09    69.85 #  27179.78 4553217.92    1     3290    19.639  0.000
SEPARATE     60.67    77.39 #  48675.31  862354.73    1      697    39.342  0.000
```

FIGURE 149

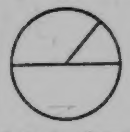
LEVEL E (Grade 5)

GEOMETRY

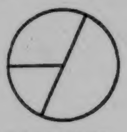
OBJECTIVE 4 *Identifies radius, diameter and circumference.*

TEST ITEMS

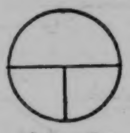
21. On each circle use a red crayon to trace



(a) the circumference



(b) the diameter



(c) the radius

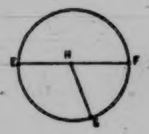
22. Write the best answer on the blank:
$\overline{EF}$ on the circle below is the

(a) diagonal

(b) circumference

(c) diameter

(d) radius



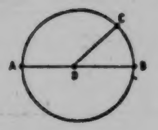
23. Write the best answer on the blank:
$\overline{DC}$ on the circle below is the

(a) diameter

(b) polygon

(c) circumference

(d) radius



ANALYSIS

```
 ZONE ONE  PUPILS IN 1978 AND 1979 ACHIEVING WITHIN EACH CATAGORY A-D
     CRITERION CATEGCRIES FOR    GRADE:5   STRAND:4   OBJECTIVE: 4
          TOTAL NUMBER OF PUPILS:  1978 N=2129   1979 N=1862

            A: BELOW 50%       B:  50-64%        C:  65-84%        D: 85-100%
        ____1978____1979_____1978____1979_____1978____1979_____1978____1979
NUMBER(%)   51.62    45.27    6.25    7.84     7.00    6.87     35.13   40.01
MEAN (%)    15.90    16.68   57.14   57.14    71.43   71.43     98.22   98.77

          TABLES COMPARING 1978 AND 1979 MEAN SCORES AND PROPORTIONS
   ___PROPORTION TEST___ #  ____________________F-TEST_____________________
   HO: PRCPOR78=PROPOR79 #  ________SS________  ______DF______
   _T-CALC___DF____PROB_#__BETWEEN_____WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
A:   4.002  3989  0.000 #    288.44  512127.65     1      1940    1.093  0.296
B:  -1.970  3989  0.049 #      0.0        0.00     1       277    0.0    1.000
C:   0.154  3989  0.878 #      0.0        0.00     1       275    0.0    1.000
D:  -3.176  3989  0.002 #    112.47   28559.02     1      1451    5.872  0.016

     ______COMPARING THE MEAN SCORES OF PUPILS WITHIN ZONE SUBGROUPS______
                           ____________________F-TEST TABLE_________________
GROUPS         YEARS       #  ________SS________  ______DF______
======______1978____1979__#__BETWEEN_____WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
EARLY        49.05   55.02 #  22959.83 4127111.67     1      2598   14.453  0.000
LATE         56.74   58.20 #    674.67 1973306.53     1      1268    0.434  0.510
MALE         49.42   54.93 #  15376.06 3178156.00     1      2030    9.821  0.002
FEMALE       53.21   58.05 #  11409.32 3136549.14     1      1957    7.119  0.008
NORTH        42.99   47.23 #   6440.86 2277662.02     1      1439    4.069  0.044
SOUTH        56.03   61.61 #  19832.05 3876868.71     1      2548   13.034  0.000
PUBLIC       50.41   56.97 #  35245.05 5239049.78     1      3290   22.133  0.000
SEPARATE     55.48   54.11 #    324.86 1077783.81     1       697    0.210  0.647
```

FIGURE 150

using slides, flips and turns in at least three of the four items utilized. Also less than fifteen percent of the pupils could not distinguish between similar and congruent figures.

Almost one-half of the zone pupils could not identify corresponding sides and angles, yet one-third of the sample could respond with 98 percent accuracy.

Significantly more pupils in 1979 could identify the radius, diameter, and circumference in circles than in 1978. Still only forty percent of the Zone group could name all three.

GRAPHING (Five objectives; Figures 151 to 155)

Hypothesis 1

None of the objectives had performances where eighty percent of the Zone One pupils in 1978 and 1979 were in the 85-100 percent achievement category.

Hypothesis 2

All five objectives had significant increases in the proportion of pupils achieving at the 85-100 percent level in 1979 over 1978.

Findings

Two-thirds of the grade five pupils could interpret and solve problems involving the bar and line graphs within the achievement range of categories C and D (65-100 percent).

One-third of the pupils could not achieve any success with constructing line and pictographs. About half of the students could construct both with fair accuracy (65-100

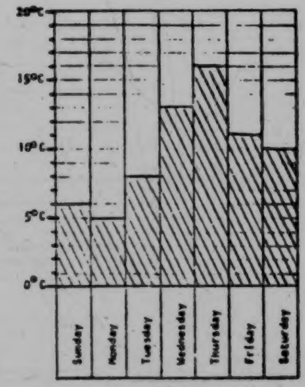
LEVEL E (Grade 5)

GRAPHING

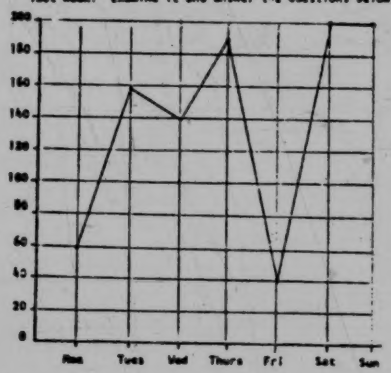
OBJECTIVE 1 *Interprets and solves problems using data collected from line, bar and pictographs.*

TEST ITEMS

24.



26. Below is a graph showing how many ice-cream cones a store sold during last week. Examine it and answer the questions below.



On what day were 190 cones sold?

____

On what day were the least number of cones sold?

____

How many were sold on that day?

____

(a) The difference between the highest and lowest temperature is _____ C.

(b) The two warmest days were ____________ and ______________.

25 One additional Item used

ANALYSIS

```
   _ZONE_ONE  PUPILS_IN_1978_AND_1979_ACHIEVING_WITHIN_EACH_CATAGORY_A-D_
      CRITERION CATEGORIES FOR     GRADE:5   STRAND:5   OEJECTIVE: 1
           TOTAL NUMBER OF PUPILS:  1978 N=2129   1979 N=1862

            A: BELOW 50%      B:  50-64%        C:  65-84%        D: 85-100%
        ____1978____1979____1978____1979_____1978____1979_____1978____1979_
NUMBER(%)   28.42   22.23   13.15   13.27    20.06   19.28    38.37   45.22
MEAN (%)    21.43   22.79   55.56   55.56    70.57   70.32    94.00   94.37

              TABLES COMPARING 1978 AND 1979 MEAN SCORES AND PROPORTIONS
    ___PROPORTION TEST___ #  ____________________F-TEST_____________________
    HO: PROPOR78=PROPOR79 #  _________SS_________  ______DF______
    _T-CALC____DF____PROB_#__BETWEEN_____WITHIN__BETWEEN_WITHIN__F-RATIC__PROB
A:    4.469  3989   0.000 #    450.18  297022.05     1     1017    1.541  0.215
B:   -0.106  3989   0.916 #      0.0        0.00     1      525    0.0    1.000
C:    0.615  3989   0.539 #     12.29   21792.75     1      784    0.442  0.506
D:'  -4.378  3989   0.000 #     54.58   51038.82     1     1657    1.772  0.183


    ______COMPARING_THE_MEAN_SCORES_OF_PUPILS_WITHIN_ZONE_SUBGROUPS______
                                ___________________F-TEST TABLE__________________
GROUPS          YEARS       #  _________SS_________  ______DF______
======______1978____1979__#__BETWEEN______WITHIN__BETWEEN_WITHIN__F-RATIC__PROB
EARLY        61.06   66.44 #  18648.72 2514626.45     1     2598   19.267  0.000
LATE         70.15   72.46 #   1687.34  996246.85     1     1268    2.148  0.143
MALE         61.92   67.84 #  17691.87 2012371.07     1     2030   17.847  0.000
FEMALE       65.38   69.53 #   8383.15 1690550.93     1     1957    9.704  0.002
NORTH        56.27   61.14 #   8471.70 1691051.44     1     1439    7.209  0.007
SOUTH        67.82   72.87 #  16165.34 1894942.67     1     2548   21.736  0.000
PUBLIC       63.57   67.31 #  11449.98 3120667.80     1     3290   12.071  0.001
SEPARATE     63.87   74.95 #  21398.96  574096.19     1      657   25.980  0.000
```

FIGURE 151

LEVEL E (Grade 5)

GRAPHING

OBJECTIVE 2 *Constructs line, bar and pictographs.*

TEST ITEMS

27. Construct a pictograph that shows how many boxes of apples each farm produced last year. Let each box contain 100 apples.

Farm A = 800 apples
Farm B = 900 apples
Farm C = 450 apples
Farm D = 700 apples
Farm E = 300 apples

28. On the grid paper below, construct a line graph that will give this information:

Number of cars sold at Bing's Used Car Lot in a six month period.

January - 40 cars	April - 30 cars
February - 20 cars	May - 60 cars
March - 50 cars	June - 20 cars

ANALYSIS

```
 _ZONE_ONE__PUPILS_IN_1978_AND_1979_ACHIEVING_WITHIN_EACH_CATAGCRY_A-D_
      CRITERION CATEGORIES FOR     GRADE:5   STRAND:5   OBJECTIVE: 2
           TOTAL NUMBER OF PUPILS:  1978 N=2129    1979 N=1862

            A: BELOW 50%        B:  50-64%          C:  65-84%          D: 85-100%
        ____1978____1979_____1978____1979______1978____1979_____1978____1979_
NUMBER(%)  47.35    33.46     13.20    14.39     26.54    33.40    12.92    18.74
MEAN (%)   10.43    13.40     50.00    50.00     76.43    76.93   100.00   100.00

             TABLES COMPARING 1978 AND 1979 MEAN SCORES AND PROPORTIONS
   ___PROPORTION TEST___ #  ____________________F-TEST______________________
   HO: PRCPOR78=PROPOR79 #  ________SS________  ______DF______
   _T-CALC____DF____PROB_#__BETWEEN_____WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
A:    8.903  3989   0.000 #   3395.60  341141.15     1     1629   16.214  0.000
B:   -1.093  3989   0.275 #  <<<<<<<<<<<<<< SSW IS EQUAL TC ZERO >>>>>>>>>>>>>>
C:   -4.734  3989   0.000 #     73.60   78958.98     1     1185    1.105  0.294
D:   -5.056  3989   0.000 #  <<<<<<<<<<<<<< SSW IS EQUAl. TC ZERO >>>>>>>>>>>>>>

   ______COMPARING_THE_MEAN_SCORES_OF_PUPILS_WITHIN_ZONE_SUBGROUPS_______
                            ____________________F-TEST TABLE________________
GROUPS       YEARS       #  ________SS________  ______DF______
======_____1978____1979_#__BETWEEN______WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
EARLY       42.13   53.24 #  79435.90 3358756.83     1     2598   61.444  0.000
LATE        50.94   60.40 #  28310.82 1520279.73     1     1268   23.613  0.000
MALE        41.81   54.18 #  77406.31 2587444.41     1     2030   60.730  0.000
FEMALE      47.77   58.15 #  52508.87 2495880.61     1     1957   41.172  0.000
NORTH       39.15   50.10 #  42977.61 1937719.43     1     1439   31.916  0.000
SOUTH       47.93   59.48 #  84714.88 3096173.58     1     2548   69.716  0.000
PUBLIC      43.70   55.20 # 108272.99 4219054.11     1     3290   84.431  0.000
SEPARATE    49.68   60.40 #  20020.26  872298.13     1      697   15.997  0.000
```

FIGURE 152

LEVEL E (Grade 5)

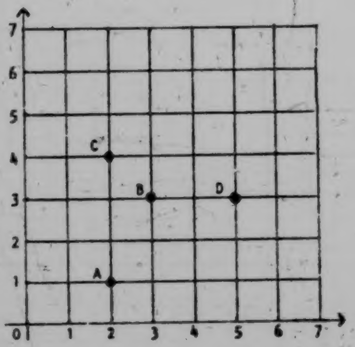
GRAPHING

OBJECTIVE 3 *Reads and writes co-ordinates from a graph.*

TEST ITEMS

29. Give co-ordinates for the following points being sure to use proper symbols.

1. Point A ____________
2. Point B ____________
3. Point C ____________
4. Point D ____________



ANALYSIS

```
 ZONE ONE  PUPILS IN 1978 AND 1979 ACHIEVING WITHIN EACH CATAGCRY A-D
     CRITERION CATEGORIES FOR    GRADE:5   STRAND:5   OBJECTIVE: 3
         TOTAL NUMBER OF PUPILS:  1978 N=2129   1979 N=1862

            A: BELOW 50%       B:  50-64%        C:  65-84%        D: 85-100%
         ____1978___1979____1978___1979____1978___1979____1978___1979_
NUMBER(%)  42.13   27.55     3.66    4.08    19.30   21.37    34.90   46.99
MEAN (%)    4.79    5.95    50.00   50.00    75.00   75.00   100.00  100.00

           TABLES CCMPARING 1978 AND 1979 MEAN SCORES AND PROPORTIONS
   ___PROPORTION TEST___ #  _____________________F-TEST______________________
   HO: PRCPOR78=PROPOR79 #  ________SS________  ______DF______
   _T-CALC____DF____PROB_#__BETWEEN_____WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
A:   9.614   3989   0.000 #   432.85  145003.32    1     1408      4.203  0.041
B:  -0.684   3989   0.494 #  <<<<<<<<<<<<<< SSW IS EQUAL TO ZERO >>>>>>>>>>>>>>
C:  -1.623   3989   0.105 #  <<<<<<<<<<<<<< SSW IS EQUAL TO ZERO >>>>>>>>>>>>>>
D:  -7.763   3989   0.000 #  <<<<<<<<<<<<<< SSW IS EQUAL TO ZERO >>>>>>>>>>>>>>


   _____COMPARING THE MEAN SCORES OF PUPILS WITHIN ZONE SUBGROUPS______
                            __________________F-TEST TABLE________________
GROUPS          YEARS      #  ________SS________  ______DF______
======_____1978___1979__#__BETWEEN_____WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
EARLY      51.52   63.74 #  96029.54 4718643.30     1     2598   52.872  0.000
LATE       57.31   71.46 #  63265.84 2042620.48     1     1268   39.274  0.000
MALE       49.93   64.21 # 103151.13 3605027.70     1     2030   58.085  0.000
FEMALE     56.64   69.30 #  78125.07 3341716.68     1     1957   45.752  0.000
NORTH      46.96   57.61 #  40596.04 2766125.86     1     1439   21.119  0.000
SOUTH      56.81   71.78 # 142304.24 4082916.35     1     2548   88.807  0.000
PUBLIC     53.11   65.06 # 116986.49 5929162.50     1     3290   64.914  0.000
SEPARATE   53.79   74.32 #  73382.62 1030159.94     1      697   49.650  0.000
```

FIGURE 153

LEVEL E (Grade 5)

GRAPHING

OBJECTIVE 4 *Generates ordered pairs from a given relationship.*

TEST ITEMS

30. Fill in the blanks:

If 2 candies cost 9¢, 4 candies cost ____________

and 10 candies cost ____________

Write ordered pairs for each of the relationships above. The first is done for you.

(2, 9)

____

____

ANALYSIS

```
 _ZONE ONE  PUPILS IN 1978 AND 1979 ACHIEVING WITHIN EACH CATAGORY A-D_
     CRITERION CATEGORIES FOR     GRADE:5   STRAND:5   OBJECTIVE: 4
          TOTAL NUMBER OF PUPILS:  1978 N=2129    1979 N=1862

            A: BELOW 50%       B:  50-64%        C:  65-84%       D: 85-100%
         ____1978___1979_____1978____1979_____1978____1979_____1978____1979_
NUMBER(%)   47.77     43.23     25.46    24.81      3.38     4.67     23.39    27.28
MEAN (%)     6.56      6.93     50.00    50.00     75.00    75.00    100.00   100.00

             TABLES COMPARING 1978 AND 1979 MEAN SCORES AND PROPORTIONS
   ___PROPORTION TEST___ #  ____________________F-TEST______________________
   HO: PRCPOR78=PROPOR79 #  ________SS________  ______DF______
   _T-CALC____DF____PROB_#__BETWEEN_____WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
A:    2.870   3989   0.004 #    58.90  223829.69    1      1820     0.479  0.489
B:    0.469   3989   0.639 #  <<<<<<<<<<<<<< SSW IS EQUAL TO ZERO >>>>>>>>>>>>>>
C:   -2.080   3989   0.038 #  <<<<<<<<<<<<<< SSW IS EQUAL TO ZERO >>>>>>>>>>>>>>
D:   -2.824   3989   0.005 #  <<<<<<<<<<<<<< SSW IS EQUAL TO ZERO >>>>>>>>>>>>>>

   ______COMPARING THE MEAN SCORES OF PUPILS WITHIN ZONE SUBGROUPS______
                             ____________________F-TEST TABLE___________________
GROUPS          YEARS       #  ________SS________  ______DF______
======______1978____1979__#__BETWEEN_____WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
EARLY        39.18    44.71  #  19679.36 3973792.75    1      2598    12.866  0.000
LATE         48.15    48.52  #     43.47 1888275.92    1      1268     0.029  0.864
MALE         41.84    46.76  #  12241.73 3038068.31    1      2030     8.180  0.004
FEMALE       41.74    45.59  #   7218.55 3041397.45    1      1957     4.645  0.031
NORTH        34.72    40.44  #  11722.05 2120909.81    1      1439     7.953  0.005
SOUTH        45.83    49.39  #   8061.39 3864126.11    1      2548     5.316  0.021
PUBLIC       41.36    46.52  #  21812.11 5010843.38    1      3290    14.321  0.000
SEPARATE     43.83    44.62  #    107.77 1066426.57    1       697     0.070  0.791
```

FIGURE 154

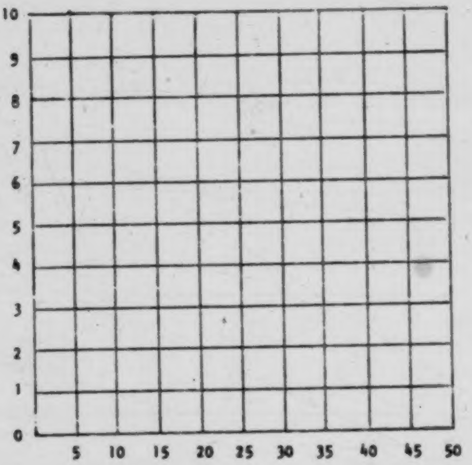
LEVEL E (Grade 5)

GRAPHING

OBJECTIVE 5 *Graphs ordered pairs from given relationships.*

TEST ITEMS

31. Plot the following ordered pairs onto the graph. Be sure to label each point you plot.



A = (5, 7)
B = (35, 9)
C = (45, 2)
D = (20, 3)

ANALYSIS

```
 ZONE ONE  PUPILS IN 1978 AND 1979 ACHIEVING WITHIN EACH CATAGCRY A-D
    CRITERION CATEGCRIES FOR     GRADE:5   STRAND:5   CBJECTIVE: 5
         TOTAL NUMBER OF PUPILS:  1978 N=2129    1979 N=1862

            A: BELOW 50%       B:  50-64%        C:  65-84%        D: 85-100%
          ____1978____1979_____1978____1979______1978_____1979______1978____1979_
NUMBER(%)  28.56    20.19      2.40     2.63      7.23     6.55     61.81    70.62
MEAN (%)    1.15     1.26     50.00    50.00     75.00    75.00    100.00   100.00

          TABLES CCMPARING 1978 AND 1979 MEAN SCORES AND PROPORTIONS
  ___PROPORTION TEST___ #  ____________________F-TEST_____________________
  HO: PRCPOR78=PROPOR79 #  ________SS________  ______DF______
   T-CALC    DF    PROB #  BETWEEN     WITHIN  BETWEEN WITHIN  F-RATIO  PROB
A:   6.117  3989  0.000 #      2.91   27969.01    1        982    0.102  0.749
B:  -0.476  3989  0.634 #  <<<<<<<<<<<<<< SSW IS EQUAL TO ZERO >>>>>>>>>>>>>>
C:   0.846  3989  0.398 #  <<<<<<<<<<<<<< SSW IS EQUAL TO ZERO >>>>>>>>>>>>>>
D:  -5.858  3989  0.000 #  <<<<<<<<<<<<<< SSW IS EQUAL TO ZERO >>>>>>>>>>>>>>

      _____COMPARING THE MEAN SCORES OF PUPILS WITHIN ZONE SUBGROUPS______
                           ____________________F-TEST TABLE_________________
GROUPS        YEARS      #  _________SS________  ______DF______
======_____1978____1979__#__BETWEEN_____WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
EARLY       66.60   75.28 #  48505.22 4805944.54    1     2598   26.221   0.000
LATE        73.78   80.40 #  13832.05 1962351.52    1     1268    8.938   0.003
MALE        65.46   75.05 #  46572.58 3820845.91    1     2030   24.744   0.000
FEMALE      72.18   79.25 #  24339.58 3150848.66    1     1957   15.117   0.000
NORTH       60.82   72.94 #  52610.58 2865294.52    1     1439   26.422   0.000
SCUTH       73.30   79.44 #  23880.92 4043839.66    1     2548   15.047   0.000
PUBLIC      69.16   76.08 #  39165.84 5806361.76    1     3290   22.192   0.000
SEPARATE    86.87   81.89 #  39321.99 1186801.04    1      697   23.094   0.000
```

FIGURE 155

percent).

About seven pupils in ten could give the coordinates for points on a grid. Slightly less than one-half of this group could do so with 100 percent accuracy, however. The increase in performance on this skill was highly significant for all subgroups.

Although three-quarters of the grade five pupils could graph ordered pairs from a given relationship less than one-third of the students could generate equivalent sets of ordered pairs when given one (Figure 154).

A. DISCUSSION OF THE GRADE FIVE RESULTS

Tables 17 to 19 indicate a somewhat low performance for the grade five pupils. As previously noted the achievement means for objectives within each of the strands vary greatly.

Number

Table 18 reveals a rather high proportion of students who are achieving within category A (Below 50) at the grade five level.

It is redundantly clear that the place value problems persist even to the grade five level. Even though the one test item in Figure 126 goes beyond the objective it, and those items in Figures 125 and 129, indicate that pupils have problems with the terminology associated with place value. The one item asks pupils to give the numeral that was provided in a named place value location. The other required

TABLE 17
THE 1978 AND 1979 ZONE ONE MEAN SCORES FOR GRADE FIVE BY OBJECTIVES AND STRAND

ZONE ONE GRADE FIVE JUNE/78

NUMBER		OPERATIONS & PROPERTIES		MEASUREMENT		GEOMETRY		GRAPHING	
1	59.4%	1	78.0%	1	66.8%	1	71.2%	1	63.6%
2	70.0%	2	66.3%	2	66.5%	2	38.2%	2	44.7%
3	36.4%	3	45.5%	3	59.8%	3	63.5%	3	53,2%
4	40.2%	4	53.8%	4	48.5%	4	51.3%	4	41.8%
5	46.6%	5	76.6%	5	43.5%			5	68.8%
6	38.1%	6	35.0%	6	41.8%				
		7	51.9%	7	73.9%				
				8	44.8%				
				9	27.2%				
				10	82.0%				
AVG	48.5%		58.1%		55.5%		56.0%		54.4%

ZONE ONE GRADE FIVE JUNE/79

NUMBER		OPERATIONS & PROPERTIES		MEASUREMENT		GEOMETRY		GRAPHING	
1	66.0%	1	80.6%	1	67.5%	1	76.5%	1	68.7%
2	75.0%	2	68.1%	2	69.7%	2	45.6%	2	56.1%
3	43.5%	3	48.0%	3	61.9%	3	71.2%	3	66.7%
4	43.4%	4	55.3%	4	59.3%	4	56.5%	4	46.2%
5	47.2%	5	72.7%	5	51.7%				
6	42.8%	6	37.1%	6	47.4%				
		7	57.7%	7	78.3%				
				8	50.2%				
				9	31.9%				
				10	88.0%				
AVG	53.0%		59.9%		60.6%		63.4%		63.0%

the naming of a place value position (eg. thousands). Two thirds of the pupils could do neither.

TABLE 18

ACHIEVEMENT MEANS IN 1978 AND 1979 WITHIN CATEGORIES A-D FOR THE NUMBER, OPERATIONS AND PROPERTIES, AND MEASUREMENT STRANDS

```
   _ZONE_ONE  PUPILS_IN_1978_AND_1979_ACHIEVING_WITHIN_EACH_CATAGORY_A-D_
       CRITERION CATEGORIES FOR  GRADE:5  STRAND: NUMBER
            TOTAL NUMBER OF PUPILS:  1978 N=2129    1979 N=1862

           A: BELOW 50%        B:  50-64%         C:  65-84%          D: 85-100%
        ____1978____1979_____1978____1979_____1978____1979_____1978____1979_
NUMBER(%)  51.01    45.76     19.68    19.87     19.92    21.75      9.39    12.62
MEAN (%)   27.31    30.14     57.26    57.12     73.44    74.02     91.85    93.10

              TABLES COMPARING 1978 AND 1979 MEAN SCORES AND PROPORTIONS
   ___PROPORTION TEST___  #  _____________________F-TEST______________________
   HO: PRCPOR78=PROPOR79  #  ________SS________  ______DF______
   _T-CALC____DF____PROB_#__BETWEEN______WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
A:    3.312   3989   0.001 #   3818.29  407377.75     1      1936   18.146  0.000
B:   -0.151   3989   0.880 #      3.73   14288.34     1       787    0.205  0.651
C:   -1.426   3989   0.154 #     70.13   27421.03     1       827    2.115  0.146
D:   -3.263   3989   0.001 #    169.36    9832.32     1       433    7.458  0.007

   _ZONE_ONE  PUPILS_IN_1978_AND_1979_ACHIEVING_WITHIN_EACH_CATAGORY_A-D_
       CRITERION CATEGORIES FOR  GRADE:5  STRAND: OPERATIONS & PROPERTIES
            TOTAL NUMBER OF PUPILS:  1978 N=2129    1979 N=1862

           A: BELOW 50%        B:  50-64%         C:  65-84%          D: 85-100%
        ____1978____1979_____1978____1979_____1978____1979_____1978____1979_
NUMBER(%)  32.97    29.81     23.30    25.19     34.81    34.05      8.92    10.96
MEAN (%)   33.14    34.52     57.48    57.54     74.12    74.22     89.74    90.15

              TABLES COMPARING 1978 AND 1979 MEAN SCORES AND PROPORTIONS
   ___PROPORTION TEST___  #  _____________________F-TEST______________________
   HO: PRCPOR78=PROPOR79  #  ________SS________  ______DF______
   _T-CALC____DF____PROB_#__BETWEEN______WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
A:    2.149   3989   0.032 #    591.23  181164.58     1      1255    4.096  0.043
B:   -1.392   3989   0.165 #      0.80   15563.78     1       963    0.049  0.824
C:    0.501   3989   0.617 #      2.70   43515.97     1      1373    0.085  0.771
D:   -2.147   3989   0.032 #     17.07    5440.76     1       392    1.230  0.268

   _ZONE_ONE__PUPILS_IN_1978_AND_1979_ACHIEVING_WITHIN_EACH_CATAGORY_A-D_
       CRITERION CATEGORIES FOR  GRADE:5  STRAND: MEASUREMENT
            TOTAL NUMBER OF PUPILS:  1978 N=2129    1979 N=1862

           A: BELOW 50%        B:  50-64%         C:  65-84%          D: 85-100%
        ____1978____1979_____1978____1979_____1978____1979_____1978____1979_
NUMBER(%)  39.41    29.43     22.69    24.54     27.99    32.49      9.91    13.53
MEAN (%)   32.50    34.09     57.32    57.81     73.90    73.82     90.64    91.46

              TABLES COMPARING 1978 AND 1979 MEAN SCORES AND PROPORTIONS
   ___PROPORTION TEST___  #  _____________________F-TEST______________________
   HO: PRCPOR78=PROPOR79  #  ________SS________  ______DF______
   _T-CALC____DF____PROB_#__BETWEEN______WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
A:    6.604   3989   0.000 #    842.34  241112.53     1      1385    4.839  0.028
B:   -1.379   3989   0.168 #     55.64   15675.63     1       938    3.330  0.068
C:   -3.090   3989   0.002 #      1.86   38353.90     1      1199    0.058  0.810
D:   -3.566   3989   0.001 #     76.73    8795.99     1       461    4.021  0.046
```

TABLE 19

ACHIEVEMENT MEANS IN 1978 AND 1979 WITHIN CATEGORIES A-D FOR THE GEOMETRY AND GRAPHING STRANDS

```
   _ZONE_ONE__PUPILS_IN_1978_AND_1979_ACHIEVING_WITHIN_EACH_CATAGORY_A-D_
       CRITERION CATEGORIES FOR  GRADE:5  STRAND: GEOMETRY
             TOTAL NUMBER OF PUPILS:  1978 N=2129    1979 N=1862

           A: BELOW 50%      B:  50-64%        C:  65-84%        D: 85-100%
       ____1978____1979_____1978____1979______1978____1979_____1978____1979_
NUMBER(%)  39.88    30.72     19.07    17.72      22.55    28.20     18.51    23.36
MEAN (%)   27.68    30.32     57.17    57.32      74.01    74.49     94.09    93.92

            TABLES COMPARING 1978 AND 1979 MEAN SCORES AND PROPORTIONS
   ___PROPORTION TEST___ #  ____________________F-TEST______________________
   HO: PROPOR78=PROPOR79 #  ________SS________  ______DF______
   _T-CALC____DF____PROB_#__BETWEEN_____WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
A:    6.028  3989   0.000 #   2372.08  339927.89     1      1419    9.902  0.002
B:    1.095  3989   0.274 #      3.67   14845.88     1       734    0.181  0.670
C:   -4.102  3989   0.000 #     58.18   30246.48     1      1003    1.929  0.165
D:   -3.772  3989   0.000 #      6.02   23861.36     1       827    0.209  0.648


   _ZONE_ONE__PUPILS_IN_1978_AND_1979_ACHIEVING_WITHIN_EACH_CATAGORY_A-D_
       CRITERION CATEGORIES FOR  GRADE:5  STRAND: GRAPHING
             TOTAL NUMBER OF PUPILS:  1978 N=2129    1979 N=1862

           A: BELOW 50%      B:  50-64%        C:  65-84%        D: 85-100%
       ____1978____1979_____1978____1979______1978____1979_____1978____1979_
NUMBER(%)  39.55    26.96     17.38    17.72      27.20    32.01     15.88    23.31
MEAN (%)   24.11    26.57     57.87    58.04      74.23    74.87     92.28    92.42

            TABLES COMPARING 1978 AND 1979 MEAN SCORES AND PROPORTIONS
   ___PROPORTION TEST___ #  ____________________F-TEST______________________
   HO: PROPOR78=PROPOR79 #  ________SS________  ______DF______
   _T-CALC____DF____PROB_#__BETWEEN_____WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
A:    8.395  3989   0.000 #   1915.90  385777.14     1      1342    6.665  0.010
B:   -0.285  3989   0.776 #      5.12   12697.11     1       698    0.282  0.596
C:   -3.328  3989   0.001 #    119.20   37671.91     1      1173    3.712  0.054
D:   -8.930  3989   0.000 #      3.67   16346.37     1       770    0.173  0.678
```

It would appear from the two rounding items that grade five pupils have difficulty identifying the tenths and hundredths positions in numbers. This is evidenced by the fact that the rounding of whole numbers has a significantly better achievement picture than did the rounding of decimals.

Pupils do not appear to have the background that is required for success with proportional ratios. While the basic multiplication facts are involved and perhaps cause a part of the difficulty the amount of time devoted to the topic of ratios is probably as much or more to blame for the low achievement. The currently authorized textbooks give little coverage to the topic of ratios either.

Operations and Properties

The majority of the grade five group had some success with the addition, subtraction and multiplication whole number algorithms. At least two thirds of the students achieved above the 65 percent level. As expected the operations with decimals were less well done. About one third of the pupils achieved within the below 50 category.

The grade five basic facts test was the most extensive of the six grades. The fact that less than fifty percent of the pupils reach the mastery category (85-100 percent) on the facts likely has an influence on achievement.

It is informative to examine the word problems used in Figure 135 to see where some of the difficulties lie with the problem solving objective. Two of the items use the multiplication and division operations in which many pupils experience frustrations. Another of the word problems required the dual use of the addition and subtraction operations. Still the achievement picture for this topic has not been bright, at least to the grade five level.

The items used to test how well students can divide whole numbers using one and two digit divisors had a wide range of difficulty. If the items are in fact representative of what children know, then it is disappointing to note that less than half of the pupils could effectively handle the operation when it has existed in some form of the program since grade two.

Measurement

The results from Tables 17 and 18 would suggest that the grade five measurement strand is somewhat heavy. Many of the ten objectives represent new material which, when added to previously unmastered objectives in the measurement sequence, spell frustration. These new concepts include the 24-hour clock, scale drawings, volume and the metric prefixes, symbols and equivalent measures within units.

The primary weakness in the measurement strand, as at grade four is, still the metric system. Students in grade four for example, could not identify equivalent measures of capacity and the grade five performance shows little improvement. The difficulty, as the evidence from Figure 144 perhaps suggests, is that students do not know the metric prefix values. Since this is a basic recall item it may be that little time is devoted to the topic. Grade five students did have improved success with knowing which are the appropriate units to use in measurement situations however.

The proportions of students within category D for scale items in 1979 would suggest that more time is being devoted to this concept. The one item used to test drawing to scale requires that pupils understand the 0.5 cm notation and thus may be checking as much for knowledge of decimal notation and the ~~centimetre~~ centimetre as it does of scale.

The volume objective called for work with rectangular solids. The items in Figure 142 test student recall of the solid since there are hidden sides. This may be valid although the test item appears more difficult than the objective. Still about two-thirds of the pupils could find the volume of a cube.

For a new topic the 24-hour clock is handled well. Also grade five pupils have more success with the reading and writing of time, an indication perhaps that more children at this level have watches.

Geometry

The improved achievement in geometry from 1978 to 1979 for all objectives may be a reflection of the increased attention given this strand.

Some students appeared to confuse the concepts of similarity and congruency. The grade four items checked for knowledge of congruent figures only and students did much better on them.

The naming of corresponding sides in figures was first introduced in grade three. Since student performance on corresponding sides in grade three showed low achievement, similar to that in grade five the treatment of this concept should perhaps be reviewed.

The items used to test pupil recall of the terms radius, diameter and circumference may be a reflection of the time and importance alloted to the concept.

Graphing

The difficulty grade five pupils have in constructing graphs appears to be with the developing of scale. This is supported by the achievement scores by grade four pupils who were provided a scale with which to construct their graph. Students may also be experiencing difficulties with the visualizing of the graphing problems; perhaps they represent an extension or a part of the world of problem solving within which it appears that pupils fail.

Although the mathematics objectives have supposidly involved students in the reading, writing and graphing of ordered pairs since grade three, it appears as though they are still not able to write or generate such number pairs with any consistency.

CHAPTER IX

GRADE SIX

ANALYSIS OF HYPOTHESIS ONE AND TWO FOR GRADE SIX

NUMBER (Seven objectives; Figures 158 to 164)

Hypothesis 1

None of the objectives had performances where eighty percent of the Zone One pupils in 1978 and 1979 were in the 85-100 percent achievement level.

Hypothesis 2

All seven objectives had significant increases in the proportion of pupils achieving at the 85-100 percent level in 1979 over 1978.

Findings

The grade six mean score for each of the place value objectives, including the rounding of numerals and expanded notation was in the 50 and low 60 percent range; however, more than one-third of the pupils failed to show a reasonable understanding of the concepts involved.

About thirty percent of the students could express halves, quarters and fifths as common fractions or decimals with complete accuracy. The achievement figures for over one-half of the Zone One pupils were within the lower A and B categories on this skill.

Close to eight of every ten pupils could identify and order integers. The mean score for performance on this skill

PART I

PART	QUESTION	STRAND	OBJECTIVE	RAW SCORE VALUE
1	1	Number	1	10
1	2	Number	2	10
1	3	Number	3	12
1	4	Number	4	4
1	5	Number	4	4
1	6	Number	4	6
1	7	Number	5	6
1	8	Number	5	5
1	9	Number	6	12
1	10	Number	7	12
1	11	Operations & Properties	1	8
1	12	Operations & Properties	2	8
1	13	Operations & Properties	3	6
1	14	Operations & Properties	4	8
1	15	Operations & Properties	5	8
1	16	Operations & Properties	6	8
1	17	Operations & Properties	8	1
1	18	Operations & Properties	8	1
1	19	Operations & Properties	8	1
1	20	Operations & Properties	8	1
1	21	Operations & Properties	9	1
1	22	Operations & Properties	8	1
1	23	Operations & Properties	8	1
1	24	Operations & Properties	8	1
1	25	Operations & Properties	7	10

FIGURE 156

GRADE SIX DETAILED ANALYSIS OF MARK WEIGHTINGS

PART II

PART	QUESTION	STRAND	OBJECTIVE	RAW SCORE VALUE
II	1	Measurement	1	6
II	2	Measurement	2	3
II	3	Measurement	2	3
II	4	Measurement	3	3
II	5	Measurement	3	3
II	6	Measurement	4	5
II	7	Measurement	5	3
II	8	Measurement	5	3
II	9	Measurement	6	8
II	10	Measurement	7	4
II	11	Measurement	7	4
II	12	Geometry	1	12
II	13	Geometry	2	2
II	14	Geometry	2	2
II	15	Geometry	2	2
II	16	Geometry	2	2
II	17	Geometry	2	2
II	18	Geometry	2	2
II	19	Geometry	3	12
				SUB-TOTAL = 36
II	20	Graphing	1	12
II	21	Graphing	2	12

FIGURE 157

GRADE SIX DETAILED ANALYSIS OF MARK WEIGHTINGS

LEVEL F (Grade 6)

NUMBER

OBJECTIVE 1 *Expresses halves, quarters and fifths as fractions or decimals.*

TEST ITEMS

1. A. Change the following to decimal fractions:

a. $\frac{1}{2}$

b. $\frac{3}{4}$

c. $\frac{4}{5}$

B. Change the following to common fractions:

a. 0.25

b. 0.40

ANALYSIS

```
 _ZONE_ONE__PUPILS_IN_1978_AND_1979_ACHIEVING_WITHIN_EACH_CATAGORY_A-D_
     CRITERION CATEGORIES FOR     GRADE:6   STRAND:1   OBJECTIVE: 1
           TOTAL NUMBER OF PUPILS:  1978 N=1897    1979 N=1668

                                                            D: 85-100%
                                 B:  50-64%       C:  65-84%
             A: BELOW 50%                                  1978____1979_
                            ____1978____1979_____1978____1979_____24.09    31.89
          ____1978____1979                       12.18    16.31
NUMBER(%)   50.71    37.95     13.02    13.85                     98.25    99.04
MEAN (%)    16.80    17.25     58.26    58.35    78.05    78.16

              TABLES COMPARING 1978 AND 1979 MEAN SCORES AND PROPORTIONS
                                   ______________________F-TEST______________________
    ___PROPORTION TEST___ #   ________________SS_________  ______DF______
    HO: PROPOR78=PROPOR79 #   _________SS_________   ____WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
    _T-CALC____DF____PROB_#__BETWEEN_____WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
                                 78.29  501555.94     1      1593     0.249   0.618
A:    7.647   3563   0.000 #      1.10    6726.31     1       476     0.078   0.781
B:   -0.724   3563   0.469 #      1.51    7704.26     1       501     0.098   0.754
C:   -3.534   3563   0.001 #    154.16   11210.65     1       987    13.572   0.000
D:   -5.193   3563   0.000 #

       _____COMPARING_THE_MEAN_SCORES_OF_PUPILS_WITHIN_ZONE_SUBGROUPS_______
                                   ____________________F-TEST TABLE__________________
                                 ____________________  ______DF______
GROUPS          YEARS        #   _________SS_________  
======_____1978____1979__#__BETWEEN_____WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
                                                          2253    34.652   0.000
EARLY       47.47    56.79 #  48382.59 3145738.21    1    1157    18.930   0.000
LATE        53.35    62.61 #  24858.23 1519313.30    1    1823    21.528   0.000
MALE        47.76    55.93 #  30303.42 2566083.21    1    1738    41.150   0.000
FEMALE      50.88    62.13 #  54898.46 2318679.64    1     963    26.614   0.000
NORTH       45.80    58.13 #  36588.04 1323892.37    1    2598    35.933   0.000
SOUTH       50.54    59.28 #  49414.67 3572769.33    1    2873    82.176   0.000
PUBLIC      49.29    59.29 #  71805.83 3937352.46    1     668     8.889   0.004
SEPARATE    49.21    57.60 #  12075.68  967325.05    1
```

FIGURE 158

LEVEL F (Grade 6)

NUMBER

OBJECTIVE 2 *Rounds numerals to required accuracy including thousandths.*

TEST ITEMS

2. Round off the following numbers as required:

   a. Round 3.8 off to the nearest whole number. ____________

   b. Round 5.43 off to the nearest tenth. ____________

   c. Round 7.27 off to the nearest tenth. ____________

   d. Round 6.485 off to the nearest hundredth. ____________

   e. Rewrite the following decimal fraction rounded off to the nearest hundredth.
   0.36653 ____________

ANALYSIS

```
 _ZONE_ONE__PUPILS_IN_1978_AND_1979_ACHIEVING_WITHIN_EACH_CATAGCRY_A-D_
      CRITERION CATEGCRIES FOR     GRADE:6   STRAND:1   OBJECTIVE: 2
          TOTAL NUMBER OF PUPILS:  1978 N=1897    1979 N=1668

          A: BELOW 50%       B:  50-64%        C:  65-84%         D: 85-100%
      ____1978____1979_____1978____1979_____1978____1979_____1978____1979_
NUMBER(%)  45.60    32.87    13.28   13.13     14.18   19.36     26.94    33.63
MEAN (%)   14.42    15.75    59.88   59.91     79.93   79.88     99.90    99.82

          TABLES COMPARING 1978 AND 1979 MEAN SCORES AND PROPORTIONS
   ___PROPORTION TEST___ #  _____________________F-TEST______________________
   HC: PRCPOR78=PROPOR79 #  _________SS_________  ______DF______
   _T-CALC____DF____PROB_#__BETWEEN_____WITHIN__BETWEEN_WITHIN__F-RATIO__PECB
A:    7.127   3563   0.000 #    610.04  323735.48     1      1428     2.691  0.101
B:    0.136   3563   0.892 #      0.09     494.60     1       469     0.085  0.770
C:   -4.150   3563   0.000 #      0.36     593.56     1       590     0.357  0.550
D:   -4.350   3563   0.000 #      1.73    1477.28     1      1070     1.252  0.263

      ______COMPARING_THE_MEAN_SCORES_OF_PUPILS_WITHIN_ZONE_SUBGROUPS_______
                              ____________________F-TEST TABLE_________________
GROUPS          YEARS      #  _________SS_________  ______DF______
======_____1978____1979___#__BETWEEN______WITHIN__BETWEEN_WITHIN__F-RATIO__PECB
EARLY        51.06    58.66 #  32147.83 3289894.92     1      2253    22.016  0.000
LATE         56.39    68.43 #  41991.12 1534678.42     1      1157    31.657  0.000
MALE         52.70    60.72 #  29166.07 2581254.42     1      1823    20.598  0.000
FEMALE       52.85    63.84 #  52331.83 2474708.17     1      1738    36.753  0.000
NORTH        48.50    62.46 #  46922.84 1366980.37     1       963    33.056  0.000
SOUTH        54.32    62.16 #  39710.81 3680426.07     1      2598    28.032  0.000
PUBLIC       53.80    62.14 #  49743.95 4104050.63     1      2873    34.823  0.000
SEPARATE     48.51    62.68 #  34466.73  947576.17     1       688    25.025  0.000
```

FIGURE 159

LEVEL F (Grade 6)

NUMBER

OBJECTIVE 3 *Writes decimal numerals using expanded notation.*

TEST ITEMS

3. Rewrite the following decimal numerals using expanded notation.

1. 6.4 ______________________________
2. 3.83 ______________________________
3. 4.769 ______________________________
4. 5.9 ______________________________
5. 6.05 ______________________________
6. 47.203 ______________________________

ANALYSIS

```
   ZONE ONE  PUPILS IN 1978 AND 1979 ACHIEVING WITHIN EACH CATAGORY A-D
      CRITERION CATEGORIES FOR     GRADE:6   STRAND:1   OBJECTIVE: 3
           TOTAL NUMBER OF PUPILS:  1978 N=1897    1979 N=1668

            A: BELOW 50%      B:  50-64%       C:  65-84%        D: 85-100%
                                                1978    1979     1978    1979
           1978    1979     1978    1979       8.07    8.99     30.73   41.13
NUMBER(%)  58.67   47.06     2.53    2.82     79.30   78.67     99.73   99.81
MEAN (%)    2.95    3.70    50.52   50.18

           TABLES COMPARING 1978 AND 1979 MEAN SCORES AND PROPORTIONS
      ___PROPORTION TEST___  #  __________________F-TEST_____________________
      HO: PRCPOR78=PROPOR79  #  ________SS________   ______DF______
      _T-CALC____DF____PROB_#__BETWEEN_____WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
                                                       1      1896    2.994   0.084
A:     6.932   3563   0.000 #    262.33  166136.40     1        93    0.990   0.322
B:    -0.532   3563   0.595 #      2.80     263.28     1       301    0.590   0.443
C:    -0.991   3563   0.322 #     30.65   15636.75     1      1267    1.008   0.316
D:    -6.468   3563   0.000 #      1.88    2361.64     1

       ______COMPARING THE MEAN SCORES OF PUPILS WITHIN ZONE SUBGROUPS_______
                                    ___________________F-TEST TABLE________________
                                  ________SS________   ______DF______
GROUPS          YEARS         #  BETWEEN_____WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
======_____1978_____1979__#__BETWEEN                1      2253    26.524   0.000
EARLY       38.11    48.11  #  55588.71 4721833.56     1      1157    27.163   0.000
LATE        41.88    56.00  #  57727.48 2458920.61     1      1823    15.091   0.000
MALE        39.28    47.67  #  32013.29 3867258.01     1      1738    41.472   0.000
FEMALE      40.87    55.04  #  87030.24 3647260.79     1       963    10.669   0.001
NORTH       37.03    46.54  #  21771.92 1965162.16     1      2598    43.081   0.000
SOUTH       41.18    53.08  #  92075.48 5552658.47     1      2873    45.731   0.000
PUBLIC      40.55    52.16  #  96505.67 6062921.72     1       688     7.379   0.007
SEPARATE    38.01    47.59  #  15746.72 1468120.43     1
```

FIGURE 160

LEVEL F (Grade 6)

NUMBER

OBJECTIVE 4 *Identifies place value to billions*
(0.0001 - 1 000 000 000)

TEST ITEMS

4. State what place value the digit 6 is in the following numerals.

A. 347.516 ____________________

B. 651.053 ____________________

5. A. On the blank, write the number that has a 5 in the tenths place.

a. 638.518 b. 251.053 c. 332.051 d. None ____________

B. On the blank, write the number that has a 7 in the thousandths place.

a. 156.527 b. 905.725 c. 362.374 d. None ____________

6. Rewrite the following numbers using words.

3 579 147.268

____

____

365 148.29

____

____

ANALYSIS

```
   _ZONE_ONE__PUPILS_IN_1978_AND_1979_ACHIEVING_WITHIN_EACH_CATAGORY_A-D_
        CRITERION CATEGORIES FOR     GRADE:6   STRAND:1   OBJECTIVE: 4
              TOTAL NUMBER OF PUPILS:  1978 N=1897   1979 N=1668

             A: BELOW 50%      B:  50-64%        C:  65-84%        D: 85-100%
          ____1978____1979_____1978____1979_____1978____1979_____1978____1979_
NUMBER(%)  50.76     37.89     20.88    19.42      6.59     8.51     21.77    34.17
MEAN (%)   17.57     20.29     57.56    57.50     76.17    76.06     95.47    96.27

          TABLES COMPARING 1978 AND 1979 MEAN SCORES AND PROPORTIONS
   ___PROPORTION TEST___ #  ____________________F-TEST_______________________
   HO: PROPOR78=PROPOR79 #  _________SS________  ______DF______
   _T-CALC____DF_____PROB_#__BETWEEN______WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
A:    7.714  3563   0.000 #   2813.72  486738.26      1     1593    9.209  0.003
B:    1.076  3563   0.282 #      0.69    5860.92      1      718    0.084  0.772
C:   -2.177  3563   0.030 #      0.88    3075.63      1      265    0.076  0.783
D:   -8.268  3563   0.000 #    152.11   38775.27      1      981    3.848  0.050

   ______COMPARING_THE_MEAN_SCORES_OF_PUPILS_WITHIN_ZONE_SUBGROUPS_______
                            ____________________F-TEST TABLE_________________
GROUPS        YEARS      #  _________SS________  ______DF______
======_____1978____1979__#__BETWEEN______WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
EARLY        44.53   55.01 # 61169.88 2748485.85     1     2253   50.142  0.000
LATE         51.44   63.75 # 43902.49 1306019.24     1     1157   38.893  0.000
MALE         46.34   56.41 # 45979.63 2160001.27     1     1823   38.806  0.000
FEMALE       47.16   60.13 # 72923.13 2102751.84     1     1738   60.274  0.000
NORTH        43.14   59.84 # 67173.64 1167417.88     1      963   55.411  0.000
SOUTH        48.04   57.61 # 59170.54 3090844.45     1     2598   49.736  0.000
PUBLIC       48.10   59.62 # 95048.25 3349465.39     1     2873   81.528  0.000
SEPARATE     41.10   52.36 # 21776.91  891099.75     1      688   16.814  0.000
```

FIGURE 161

LEVEL F (Grade 6)

NUMBER

OBJECTIVE 5 *Identifies and orders integers.*

TEST ITEMS

7. Place the opposite value of each integer on the blanks:

a. -1 ____________

b. 2 ____________

c. -3 ____________

d. -6 ____________

e. 4 ____________

f. 5 ____________

8. Put the correct sign (> = <) to compare the integers below:

a. 6 ☐ -6

b. 0 ☐ -6

c. -7 ☐ 3

d. -6 ☐ -4

e. -9 ☐ -7

ANALYSIS

```
    ZONE ONE   PUPILS IN 1978 AND 1979 ACHIEVING WITHIN EACH CATAGCRY A-D
        CRITERION CATEGCRIES FOR     GRADE:6   STRAND:1   OBJECTIVE: 5
             TOTAL NUMBER OF PUPILS:  1978 N=1897   1979 N=1668

           A: BELOW 50%        B:  50-64%         C:  65-84%        D: 85-100%
        ____1978____1979_____1978____1979_____1978____1979_____1978____1979_
NUMBER(%)   19.98    11.39     10.44    10.31     18.40    19.78     51.19    58.51
MEAN (%)    22.28    22.78     58.95    58.40     77.75    77.77     98.72    98.77

            TABLES CCMPARING 1978 AND 1979 MEAN SCORES AND PROPORTIONS
   ___PROPORTION TEST___ #  ____________________F-TEST_______________________
   HO: PRCPOR78=PROPOR79 #  _________SS_________  ______DF______
   _T-CALC____DF____PROB_#__BETWEEN______WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
A:    6.986  3563   0.000 #    30.58  160110.88     1       567    0.108  0.742
B:    0.123  3563   0.902 #    27.78    7559.67     1       368    1.352  0.246
C:   -1.052  3563   0.293 #     0.03   13866.74     1       677    0.002  0.968
D:   -4.385  3563   0.000 #     1.37   19158.51     1      1945    0.140  0.709

     ______COMPARING THE MEAN SCORES OF PUPILS WITHIN ZCNE SUBGROUPS_______
                            ____________________F-TEST TABLE___________________
GROUPS       YEARS       #  _________SS_________  ______DF______
======______1978____1979__#__BETWEEN______WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
EARLY       73.10    80.63 #  31500.45 1979147.47     1      2253   35.859  0.000
LATE        80.81    84.38 #   3704.57  760665.83     1      1157    5.635  0.018
MALE        75.62    81.24 #  14338.56 1536348.00     1      1823   17.014  0.000
FEMALE      75.25    82.38 #  22024.26 1359009.08     1      1738   28.166  0.000
NORTH       72.19    81.01 #  18729.52  804261.44     1       963   22.426  0.000
SOUTH       76.62    82.10 #  19400.63 2084023.37     1      2598   24.185  0.000
PUBLIC      77.33    81.77 #  14104.83 2220900.68     1      2873   18.246  0.000
SEPARATE    67.60    81.90 #  35108.22  646919.45     1       688   37.334  0.000
```

FIGURE 162

LEVEL F (Grade 6)

NUMBER

OBJECTIVE 6 *Identifies applications of proportional ratios.*

TEST ITEMS

9. Answer the following ratio questions.

a. Jane typed 40 words in one minute. Give the ratio of words to minutes.

____

b. Jim had 8 mice and 3 cats. Give the ratio of mice to cats.

____

c. At Sue's party, there were 3 boys to every 2 girls. There were 9 boys at the party. How many girls at the party?

____

d. There are 36 children in a class. The ratio of boys to girls is 5:4. How many boys are there in the class?

ANALYSIS

```
 _ZONE_ONE__PUPILS_IN_1978_AND_1979_ACHIEVING_WITHIN_EACH_CATAGORY_A-D_
      CRITERION CATEGORIES FOR     GRADE:6   STRAND:1   OBJECTIVE: 6
          TOTAL NUMBER OF PUPILS:  1978 N=1897    1979 N=1668

             A: BELOW 50%       B:  50-64%        C:  65-84%        D: 85-100%
         ____1978____1979_____1978____1979_____1978____1979_____1978____1979_
NUMBER(%)    41.01    29.50     23.09    23.68     22.30    26.26     13.60    20.56
MEAN (%)     13.77    14.87     50.08    50.17     74.94    75.00    100.00    99.98

           TABLES COMPARING 1978 AND 1979 MEAN SCORES AND PROPORTIONS
   ___PROPORTION TEST___ #  ____________________F-TEST______________________
   HO: PROPOR78=PROPOR79 #  _________SS________  ______DF______
   _T-CALC____DF____PROB_#__BETWEEN_____WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
A:    7.164  3563   0.000 #    362.47  203851.44    1       1268     2.255  0.134
B:   -0.417  3563   0.677 #      1.78     819.54    1        831     1.809  0.179
C:   -2.757  3563   0.006 #      0.75    2012.41    1        859     0.321  0.571
D:   -5.541  3563   0.000 #      0.09      69.24    1        599     0.752  0.386


   ______COMPARING_THE_MEAN_SCORES_OF_PUPILS_WITHIN_ZONE_SUBGROUPS______
                             ____________________F-TEST TABLE__________________
GROUPS          YEARS        #  _________SS________  ______DF______
======_____1978____1979__#__BETWEEN_____WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
EARLY         45.45    54.07 #  41306.82 2385067.47    1       2253    39.020  0.000
LATE          51.74    59.87 #  19170.35 1206873.77    1       1157    18.378  0.000
MALE          47.38    55.91 #  33039.06 1998442.91    1       1823    30.139  0.000
FEMALE        47.67    57.16 #  38990.23 1791719.02    1       1738    37.821  0.000
NORTH         43.02    55.58 #  37974.74 1034337.43    1        963    35.356  0.000
SOUTH         49.16    56.88 #  38563.61 2742004.34    1       2598    36.538  0.000
PUBLIC        48.57    56.48 #  44750.01 2997657.00    1       2873    42.889  0.000
SEPARATE      43.18    56.70 #  31369.72  784546.54    1        688    27.509  0.000
```

FIGURE 163

LEVEL F (Grade 6)

NUMBER

OBJECTIVE 7 *Uses decimal fractions to express and solve for percent.*

TEST ITEMS

10. Express the following numbers as percentages:

a. $\frac{73}{100}$ ____________

b. $\frac{3}{100}$ ____________

c. 0.63 ____________

d. 0.225 ____________

e. 0.666 ____________

f. 1.25 ____________

ANALYSIS

```
 _ZONE_ONE__PUPILS_IN_1978_AND_1979_ACHIEVING_WITHIN_EACH_CATAGORY_A-D_
      CRITERION CATEGORIES FOR    GRADE:6   STRAND:1   OBJECTIVE: 7
           TOTAL NUMBER OF PUPILS:  1978 N=1897   1979 N=1668

           A: BELOW 50%      B:  50-64%        C:  65-84%        D: 85-100%
       ____1978____1979_____1978____1979_____1978____1979_____1978____1979_
NUMBER(%)  36.06    25.78     26.09    23.20     25.83    29.74     12.02    21.28
MEAN (%)   11.20    13.82     50.07    50.00     72.45    73.74     99.89    99.91

             TABLES COMPARING 1978 AND 1979 MEAN SCORES AND PROPORTIONS
   ___PROPORTION TEST___ #  ___________________F-TEST_______________________
   HO: PROPOR78=PROPOR79 #  _________SS_________  ______DF______
   _T-CALC____DF____PROB_#__BETWEEN______WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
A:    6.606   3563   0.000 #   1814.34  266181.13     1      1112    7.580  0.006
B:    1.997   3563   0.046 #      0.98     275.53     1       880    3.146  0.077
C:   -2.602   3563   0.009 #    410.78   63732.01     1       984    6.342  0.012
D:   -7.462   3563   0.000 #      0.03     480.24     1       581    0.042  0.838


   ______COMPARING_THE_MEAN_SCORES_OF_PUPILS_WITHIN_ZONE_SUBGROUPS______
                            ___________________F-TEST TABLE_________________
GROUPS        YEARS       #  _________SS_________  ______DF______
======_____1978_ __1979__#__BETWEEN______WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
EARLY       45.29    56.07 # 64788.49 2474297.62     1      2253   58.994  0.000
LATE        52.65    62.50 # 28112.18 1097664.00     1      1157   29.632  0.000
MALE        47.45    56.96 # 41135.93 2004008.82     1      1823   37.420  0.000
FEMALE      48.21    59.80 # 58203.95 1768622.20     1      1738   57.196  0.000
NORTH       39.72    56.88 # 70923.24 1013924.63     1       963   67.361  0.000
SOUTH       50.76    58.91 # 42984.82 2715803.61     1      2598   41.120  0.000
PUBLIC      48.00    58.83 # 84059.93 3007984.86     1      2873   80.288  0.000
SEPARATE    47.09    56.33 # 14680.65  766418.89     1       688   13.179  0.000
```

FIGURE 164

was around 82 percent.

Over one-half of the pupils had difficulty with identifying applications of proportional ratios. About fourty-seven percent of the Zone One grade six pupils could correctly identify at least three of the four proportional ratio items.

One in four of the grade six pupils in 1979 could not use decimal fractions to express and solve for percent. The proportions were spread rather evenly between all four achievement categories.

OPERATIONS AND PROPERTIES (Eight objectives; Figures 165 to 172)

Hypothesis 1

None of the objectives had performances where eighty percent of the Zone One pupils in 1978 and 1979 were in the 85-100 percent category.

Hypothesis 2

Three objectives had significant increases in the proportion of pupils achieving at the 85-100 percent level in 1979 over 1978.

Findings

Performances on the adding and subtracting of whole numbers were fairly constant over the two testing periods. Eighty percent of the students could solve at least two of the four problems on the test. One-quarter of the pupils answered all four of the rather large problems correctly.

LEVEL F (Grade 6)

OPERATIONS AND PROPERTIES

OBJECTIVE 1 *Adds and subtracts whole numbers.*

TEST ITEMS

11. Add or subtract to solve the following problems. Put your answers in the boxes. Show your work.

```
                          29
                       6 842
  1 000 000           98 386
-   908 147            2 594
                    + 73 967
     ☐                  ☐

                              ☐ + 816 = 1 002

                              ☐ - 57 211 = 68 433
```

ANALYSIS

```
_ZONE_ONE__PUPILS_IN_1978_AND_1979_ACHIEVING_WITHIN_EACH_CATAGORY_A-D_
     CRITERION CATEGORIES FOR    GRADE:6   STRAND:2   OBJECTIVE: 1
           TOTAL NUMBER OF PUPILS:  1978 N=1897   1979 N=1668

             A: BELOW 50%      B:  50-64%        C:  65-84%        D: 85-100%
         ____1978____1979_____1978____1979_____1978____1979_____1978____1979_
NUMBER(%)    21.51   18.05     20.14   20.98     29.52   33.33     28.83   27.64
MEAN (%)     13.97   15.41     50.36   50.21     75.00   75.00     99.61   99.88

          TABLES COMPARING 1978 AND 1979 MEAN SCORES AND PROPORTIONS
   ___PROPORTION TEST___ # ____________________F-TEST______________________
   HO: PROPOR78=PROPOR79 # ________SS________ ______DF______
   _T-CALC____DF____PROB_#__BETWEEN_____WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
A:    2.584   3563   0.010 #    357.38  111574.04     1      707     2.265  0.133
B:   -0.624   3563   0.533 #      3.88    2590.69     1      730     1.092  0.296
C:   -2.450   3563   0.015 # <<<<<<<<<<<<<< SSW IS EQUAL TO ZERO >>>>>>>>>>>>>>
D:    0.792   3563   0.429 #     16.00    3346.47     1     1006     4.810  0.029

     ______COMPARING_THE_MEAN_SCORES_OF_PUPILS_WITHIN_ZONE_SUBGROUPS______
   ______________________________________F-TEST TABLE__________________
                             # ____________________
GROUPS        YEARS          # ________SS________ ______DF______
======_____1978____1979__#__BETWEEN_____WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
EARLY       62.07   64.27 #   2701.71 2275837.92     1     2253     2.675  0.102
LATE        67.86   69.29 #    593.43  977455.80     1     1157     0.702  0.402
MALE        61.84   63.98 #   2074.42 1807086.53     1     1823     2.093  0.148
FEMALE      66.29   67.94 #   1180.06 1579642.05     1     1738     1.298  0.255
NORTH       60.12   65.00 #   5723.89  978648.51     1      963     5.632  0.018
SOUTH       65.42   66.27 #    465.18 2413037.16     1     2598     0.501  0.479
PUBLIC      65.09   65.52 #    132.91 2680817.85     1     2873     0.142  0.706
SEPARATE    59.55   67.60 #  11119.92  711566.68     1      688    10.752  0.001
```

FIGURE 165

LEVEL F (Grade 6)

OPERATIONS AND PROPERTIES

OBJECTIVE 2 *Multiplies using one, two and three digit multipliers.*

TEST ITEMS

12. Solve the following. Show your work.

a. 409 X 387 = ____________

b. 36 X 49 = ____________

c. 2 009 X 40 = ____________

d. 6 043 X 307 = ____________

ANALYSIS

```
 _ZONE_ONE__PUPILS_IN_1978_AND_1979_ACHIEVING_WITHIN_EACH_CATAGCRY_A-D_
      CRITERION CATEGCRIES FOR     GRADE:6   STRAND:2   OEJECTIVE: 2
          TOTAL NUMBER OF PUPILS:  1978 N=1897    1979 N=1668

                                                              D: 85-100%
          A: BELOW 50%       B:  50-64%          C:  65-84%
                                                1978____1979_____1978____1979_
      ____1978____1979_____1978____1979_____26.62   28.60     26.54   32.07
NUMBER(%)  26.67   22.54     19.77   16.79     75.00   75.00     99.80   99.98
MEAN (%)   11.07   12.27     50.17   50.00

          TABLES COMPARING 1978 AND 1979 MEAN SCORES AND PROPCRTIONS
   ___PROPORTION TEST___ #  ____________________F-TEST_______________________
   HC: PRCPOR78=PROPOR79 #  ________SS________  ______DF______
    T-CALC____DF____ERCB_#__BETWEEN_____WITHIN__BETWEEN_WITHIN__F-RATIO__ERCB
A:   2.853   3563   0.004 #   310.67  139409.60     1       880     1.961  0.162
B:   2.294   3563   0.022 #     4.45     770.83     1       653     3.772  0.053
C:  -1.318   3563   0.188 #  <<<<<<<<<<<<<< SSW IS EQUAL TO ZERO >>>>>>>>>>>>>>
D:  -3.361   3563   0.001 #     7.76    1386.39     1      1044     5.845  0.016


       ______COMPARING_THE_MEAN_SCORES_OF_PUPILS_WITHIN_ZONE_SUBGROUPS_______
                             ____________________F-TEST TABLE__________________
                             ________SS________  ______DF______
GROUPS           YEARS    #  BETWEEN_____WITHIN__BETWEEN_WITHIN__F-RATIO__ERCB
======______1978____1979__#__BETWEEN_____WITHIN     1      2253   13.990  0.000
EARLY       57.34   62.82 # 16739.77 2665862.50     1      1157    5.293  0.022
LATE        64.40   68.77 #  5533.00 1209524.70     1      1823   10.967  0.001
MALE        57.23   62.59 # 13027.11 2165498.92     1      1738    7.916  0.005
FEMALE      62.34   66.85 #  8824.91 1937656.41     1       963   16.324  0.000
NORTH       57.13   66.20 # 19789.89 1167429.02     1      2598    6.719  0.010
SOUTH       60.66   64.09 #  7628.51 2949558.93     1      2873    3.778  0.052
PUBLIC      61.36   63.82 #  4314.23 3280641.53     1       688   34.108  0.000
SEPARATE    52.91   68.26 # 40447.98  815893.73     1
```

FIGURE 166

LEVEL F (Grade 6)

OPERATIONS AND PROPERTIES

OBJECTIVE 3 *Divides using one, two and three digit divisors (with or without remainders).*

TEST ITEMS

13. Solve the following. Show your work.

a. 786 ÷ 6 = ____________

b. 605 ÷ 13 = ____________

c. 1 456 ÷ 253 = ____________

ANALYSIS

```
      ZONE_ONE__PUPILS_IN_1978_AND_1979_ACHIEVING_WITHIN_EACH_CATAGCRY_A-D_
          CRITERION CATEGCRIES FOR    GRADE:6   STRAND:2   CBJECTIVE: 3
                TOTAL NUMBER OF PUPILS:  1978 N=1897   1979 N=1668

                A: BELOW 50%       B:  50-64%        C:  65-84%        D: 85-100%
           ____1978____1979_____1978____1979_____1978____1979_____1978____1979_
NUMBER(%)   35.90    33.51      0.69     1.14     26.09    24.70     37.32    40.65
MEAN (%)    18.16    20.30     50.00    50.00     67.07    67.39    100.00   100.00

              TABLES CCMPARING 1978 AND 1979 MEAN SCCRES AND PROPORTIONS
   ___PROPORTION TEST___ #  ____________________F-TEST_______________________
   HO: PRCPOR78=PROPOR79 #  ________SS________  ______DF______
   _T-CALC____DF____PROB_#__BETWEEN_____WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
A:    1.492  3563   0.136 #   1411.91  334141.63     1      1238     5.231  0.022
B:   -1.433  3563   0.152 # <<<<<<<<<<<<<< SSW IS EQUAL TO ZERO >>>>>>>>>>>>>>
C:    0.953  3563   0.341 #     23.62    8034.08     1       905     2.661  0.103
D:   -2.032  3563   0.042 # <<<<<<<<<<<<<< SSW IS EQUAL TO ZERO >>>>>>>>>>>>>>

      ______COMPARING_THE_MEAN_SCORES_CF_PUPILS_WITHIN_ZONE_SUBGROUPS_______
                            ___________________F-TEST TABLE___________________
                            __________SS________  ______DF______
GROUPS          YEARS    #
======_____1978____1979__#__BETWEEN_____WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
EARLY      60.08   63.33 #   5891.68 2993880.92     1      2253     4.434  0.035
LATE       64.33   66.96 #   1998.73 1418981.05     1      1157     1.630  0.202
MALE       58.07   61.52 #   5419.43 2450227.45     1      1823     4.032  0.045
FEMALE     65.49   67.95 #   2620.61 2147934.31     1      1738     2.120  0.146
NORTH      60.86   62.75 #    864.94 1289806.91     1       963     0.646  0.422
SOUTH      61.99   65.40 #   7530.11 3348934.74     1      2598     5.842  0.016
PUBLIC     62.54   64.35 #   2343.43 3701535.80     1      2873     1.819  0.178
SEPARATE   58.13   65.99 #  10609.76  933519.07     1       688     7.819  0.005
```

FIGURE 167

LEVEL F (Grade 6)

OPERATIONS
AND PROPERTIES

OBJECTIVE 4 *Checks multiplication by division and division by multiplication.*

TEST ITEMS

14. For each problem below, an answer is given in the box. Check whether that answer is correct or incorrect, and in the blank, write "correct" or "incorrect".

a. $365\ 940 \div 642 = \boxed{570}$ ______________

Check by multiplying. Show your work.

b. $718 \times 817 = \boxed{567\ 067}$ ______________

Check by dividing. Show your work.

ANALYSIS

```
 _ZONE ONE__PUPILS IN 1978 AND 1979 ACHIEVING WITHIN EACH CATAGCRY A-D_
      CRITERION CATEGCRIES FOR     GRADE:6    STRAND:2    DEJECTIVE: 4
           TOTAL NUMBER OF PUPILS:  1978 N=1897    1979 N=1668

                                                                D: 85-100%
             A: BELOW 50%        B:  50-64%         C:  65-84%
                                                          1978____1979_
          ____1978____1979_____1978____1979_____1978____1979_____28.68   32.25
                                                          18.82   17.87    
NUMBER(%)  34.42    29.68    18.08    20.20               99.63   99.58
MEAN (%)   12.14    11.92    50.22    50.00    75.00   75.00

             TABLES COMPARING 1978 AND 1979 MEAN SCORES AND PROPCRTIONS
   ___PROPORTION TEST___ #  ______________________F-TEST______________________
   HC: PRCPOR78=PROPOR79 #  ________SS________  ______DF______
   _T-CALC____DF____PROB_#__BETWEEN_____WITHIN__BETWEEN_WITHIN__F-RATIC__PROB
                                                               0.084    0.772
A:   3.026   3563   0.003 #     13.27  180684.14     1    1146 5.982    0.015
B:  -1.610   3563   0.108 #      8.13     921.10     1     678
C:   0.734   3563   0.463 #  <<<<<<<<<<<<< SSW IS EQUAL TC ZERO >>>>>>>>>>>>>>
D:  -2.318   3563   0.021 #      0.69    5144.87     1    1080   0.145   0.703

          ______COMPARING THE MEAN SCORES OF PUPILS WITHIN ZONE SUBGROUPS______
   ______________________________F-TEST TABLE______________________________
                                 ____________________
GROUPS       YEARS         #  ________SS________  ______DF______
======_____1978____1979__#__BETWEEN_____WITHIN__BETWEEN_WITHIN__F-RATIC__PROB
                                                       2253     8.169   0.C04
EARLY       52.95   57.34 #  10722.26 2957283.98   1    1157     0.586   0.444
LATE        60.94   62.57 #    765.20 1510136.71   1    1823     2.149   0.143
MALE        52.62   55.13 #   2871.41 2436164.04   1    1738     5.201   0.023
FEMALE      59.44   63.36 #   6642.34 2219512.47   1     963     6.691   0.010
NORTH       54.55   60.63 #   8871.09 1276813.81   1    2598     2.270   0.132
SOUTH       56.45   58.60 #   2993.38 3426405.60   1    2873     3.714   0.054
PUBLIC      56.24   58.86 #   4915.99 3802800.10   1     688     4.238   0.040
SEPARATE    54.71   60.40 #   5584.97  901805.54   1
```

FIGURE 168

LEVEL F (Grade 6)

OPERATIONS AND PROPERTIES

OBJECTIVE 5 *Mentally computes simple addition, subtraction, multiplication and division problems.*

TEST ITEMS

15. Solve these problems in your head and write the answers. Do not use scratch paper.

a. 10 g + 252 g + 32 g = ______________ g

b. 150 mℓ - 28 mℓ = ______________ mℓ

c. 153 cm - 29 cm = ______________ cm

d. 43 m + 62 m = ______________ m

e. 9 X 12 cm = ______________ cm

f. 160 cm ÷ 5 = ______________ cm

g. 13 m X 11 = ______________ m

h. 192 dm ÷ 6 = ______________ dm

ANALYSIS

```
_ZONE ONE__PUPILS_IN_1978_AND_1979_ACHIEVING_WITHIN_EACH_CATAGCRY_A-D_
    CRITERION CATEGCRIES FOR     GRADE:6   STRAND:2   CEJECTIVE: 5
         TOTAL NUMBER OF PUPILS:  1978 N=1897    1979 N=1668

          A: BELOW 50%       B:  50-64%        C:  65-84%        D: 85-100%
      ____1978____1979_____1978____1979_____1978____1979_____1978____1979_
NUMBER(%)  16.66    13.67     21.14    20.74     17.61    18.47     44.60    47.12
MEAN (%)   21.36    21.22     57.42    57.51     75.00    75.00     94.53    94.70

          TABLES CCMPARING 1978 AND 1979 MEAN SCORES AND PROPCRTIONS
   ___PROPORTION TEST___ #  ____________________F-TEST______________________
   HO: PRCPOR78=PROPOR79 #  _________SS_________  ______DF______
   _T-CALC____DF____PROB_#__BETWEEN______WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
A:   2.476   3563    0.013 #      2.73  120208.38     1      542    0.012  0.912
B:   0.289   3563    0.772 #      1.69   28078.54     1      745    0.045  0.832
C:  -0.666   3563    0.506 #  <<<<<<<<<<<<<< SSW IS EGUAL TO ZERO >>>>>>>>>>>>>>
D:  -1.510   3563    0.131 #     11.93   62515.55     1     1630    0.311  0.577


  -,____COMPARING_THE_MEAN_SCORES_OF_PUPILS_WITHIN_ZONE_SUBGROUPS______
                                    __________,_________F-TEST TABLE_______________
GROUPS          YEARS         #  _________SS_________  ______DF______
======______1978____1979__#__BETWEEN______WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
EARLY        69.85    73.26  #  6478.74 1729015.58     1      2253     8.442  0.004
LATE         73.25    74.15  #   236.16  754508.77     1      1157     0.362  0.548
MALE         67.83    69.81  #  1771.64 1425454.90     1      1823     2.266  0.133
FEMALE       74.46    76.96  #  2712.42 1135342.18     1      1738     4.152  0.042
NORTH        71.56    72.34  #   145.54  771228.49     1       963     0.182  0.670
SOUTH        70.88    73.68  #  5060.57 1830950.91     1      2598     7.181  0.008
PUBLIC       71.24    72.45  #  1050.10 2156308.60     1      2873     1.399  0.237
SEPARATE     70.33    76.91  #  7439.03  441236.01     1       688    11.599  0.001
```

FIGURE 169

LEVEL F (Grade 6)

OPERATIONS AND PROPERTIES

OBJECTIVE 6 *Multiplies and divides decimals.*

TEST ITEMS

16. Solve these problems. Write your answers on the blanks. Use the space provided.

a. Multiply .3 by .9 ____________

b. Divide 25 by .5 ____________

c. Multiply 2.89 by 5.4 ____________

d. Divide 13.6 by 2.03 ____________

ANALYSIS

```
 ZONE ONE  PUPILS IN 1978 AND 1979 ACHIEVING WITHIN EACH CATAGORY A-D
_ZONE_ONE__PUPILS_IN_1978_AND_1979_ACHIEVING_WITHIN_EACH_CATAGORY_A-D_
    CRITERION CATEGORIES FOR      GRADE:6    STRAND:2    OBJECTIVE: 6
          TOTAL NUMBER OF PUPILS:   1978 N=1897     1979 N=1668

                                                              D: 85-100%
                                          C:   65-84%     1978____1979_
          A: BELOW 50%       B:  50-64%
      ____1978____1979_____1978____1979_____1978____1979_____5.38      6.53
NUMBER(%)  56.30    51.02     23.93    27.10    14.39    15.35    98.28     99.31
MEAN (%)   12.93    14.22     50.55    50.33    75.00    75.00

         TABLES COMPARING 1978 AND 1979 MEAN SCORES AND PROPORTIONS
                             _____________________F-TEST______________________
   ___PROPORTION TEST___ #  ______________________
   HO: PRCPOR78=PROPOR79 #  ________SS________   ______DF______
   _T-CALC____DF____PROB_#__BETWEEN_____WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
                                                          1917     4.819   0.028
A:    3.155   3563   0.002 #    782.67  311348.81    1     904     2.037   0.154
B:   -2.166   3563   0.031 #     10.84    4812.56    1
C:   -0.802   3563   0.423 #  <<<<<<<<<<<<<< SSW IS EQUAL TC ZERO >>>>>>>>>>>>>>
D:   -1.462   3563   0.144 #     55.64    2773.15    1     209     4.193   0.042

         _____COMPARING_THE_MEAN_SCORES_OF_PUPILS_WITHIN_ZONE_SUBGROUPS______
   ______________________________F-TEST TABLE_________________
                            ___________________
                            ________SS________   ______DF______
GROUPS        YEARS      #  _BETWEEN_____WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
======_____1978____1979__#__                                   2253    8.947   0.003
EARLY       33.99   37.77 #    7956.19 2003560.58    1        1157    4.029   0.045
LATE        38.12   41.55 #    3410.29  979264.16    1        1823    2.675   0.102
MALE        33.52   35.75 #    2272.38 1548689.44    1        1738   10.751   0.001
FEMALE      37.50   42.17 #    9459.15 1529218.56    1         963    3.196   0.074
NORTH       35.40   38.94 #    3023.80  911185.40    1        2598    8.846   0.003
SOUTH       35.48   38.88 #    7461.93 2191404.41    1        2873    2.765   0.097
PUBLIC      36.70   38.54 #    2426.52 2521626.33    1         688   21.057   0.000
SEPARATE    30.32   40.38 #   17384.16  567990.84    1
```

FIGURE 170

OPERATIONS AND PROPERTIES

LEVEL F (Grade 6)

OBJECTIVE 7 *Demonstrates mastery of basic facts.*

TEST ITEMS

25. Solve the following. You have 1.5 minutes.

A. 18 - 7 = ______

B. 4 x ______ = 36

C. 64 ÷ 8 = ______

D. 7 + ______ = 16

E. 8 x ______ = 56

F. 8 x ______ = 32

G. 56 ÷ 7 = ______

H. 9 + ______ = 15

I. 14 - 6 = ______

J. 48 = 6 x ______

K. ______ ÷ 6 = 9

L. 11 + 9 = ______

M. 33 ÷ ______ = 3

N. 9 ÷ ______ = 1

O. 9 x 0 = ______

P. 3 + ______ = 12

Q. 12 x ______ = 0

R. 21 ÷ 3 = ______

S. 4 + ______ = 19

T. 18 - ______ = 9

ANALYSIS

```
  _ZONE_ONE__PUPILS_IN_1978_AND_1979_ACHIEVING_WITHIN_EACH_CATAGORY_A-D_
      CRITERION CATEGORIES FOR     GRADE:6   STRAND:2   OBJECTIVE: 7
            TOTAL NUMBER OF PUPILS:  1978 N=1897    1979 N=1668

           A: BELOW 50%        B:  50-64%         C:  65-84%         D: 85-100%
        ____1978____1979_____1978____1979_____1978____1979_____1978____1979_
NUMBER(%)  16.61    14.81     17.19    15.89     19.61    16.55     46.60   52.76
MEAN (%)   27.75    26.44     55.21    55.28     75.40    75.43     96.63   96.72

            TABLES COMPARING 1978 AND 1979 MEAN SCORES AND PROPORTIONS
   ___PROPORTION TEST___ #  ____________________F-TEST_________________________
   HC: PROPOR78=PROPOR79 #  _________SS_________  ______DF______
   _T-CALC____DF____PROB_#__BETWEEN________WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
A:    1.469   3563   0.142 #    237.14     96964.46    1       560     1.370  0.242
B:    1.040   3563   0.299 #      0.68     14738.74    1       589     0.027  0.869
C:    2.366   3563   0.018 #      0.16     16087.34    1       646     0.006  0.937
D:   -3.669   3563   0.000 #      3.33     39163.28    1      1762     0.150  0.699


   ______COMPARING_THE_MEAN_SCORES_OF_PUPILS_WITHIN_ZONE_SUBGROUPS______
                            ____________________F-TEST TABLE____________________
GROUPS          YEARS      #  _________SS_________  ______DF______
======_____1978____1979__#__BETWEEN_______WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
EARLY       72.80   75.18 #   3139.82 1595894.77     1      2253     4.433  0.036
LATE        76.26   78.14 #   1023.43  793006.94     1      1157     1.493  0.222
MALE        72.51   74.00 #   1014.76 1373933.19     1      1823     1.346  0.246
FEMALE      75.39   78.50 #   4205.43 1121135.72     1      1738     6.519  0.011
NORTH       76.18   76.41 #     13.27  631905.48     1       963     0.020  0.887
SOUTH       73.09   76.13 #   5964.17 1871985,83     1      2598     8.277  0.004
PUBLIC      73.50   75.80 #   3776.46 2060585.07     1      2873     5.265  0.022
SEPARATE    75.61   77.91 #    910.49  444389.36     1       688     1.410  0.236
```

FIGURE 171

LEVEL F (Grade 6)

OPERATIONS AND PROPERTIES

OBJECTIVE 8 *Solves word problems. Estimates answers.*

TEST ITEMS

17. Some estimated answers are given for the problem below. Write the best estimate on the blank.

A jet plane travelled at an average speed of 815 kilometers per hour. The distance it covered is 24 329 km. Estimate the number of hours it travelled to cover that distance.

a. 300 hrs. b. 30 hours c. 3 hours d. 3 000 hours ______

18. Some estimated answers are given for the problem below. Write the best estimate on the blank.

The speedometer of Mr. Smith's car read 38 596.4 km when he started his trip to Eastern Canada. When he arrived in Toronto, the speedometer read 45 758.2 km. How many kilometers had Mr. Smith travelled?

a. 13 000 km b. 1 300 km c. 7 000 km

d. 70 000 km e. 1 200 km ______

19. Some estimated answers are given for the problem below. Write the best estimate on the blank.

Canada's dog population in 1944 was 394 369. The dog population in 1974 was 1 385 962. Estimate the increase in that time.

a. 5 000 b. 50 000 c. 5 000 000 d. 500 000 ____

20. Some estimated answers are given for the problem below. Write the best estimate on the blank.

How many days in 432 years?

a. 160 000 b. 16 000 c. 1 600 000 d. 2 800 ____

Solve the following word problems. Show your work.

21. In 1 litre there are 1 000 millilitres. How many millilitres are there in 7.824 litres?

22. The North Sea has an average depth of about 308 metres. The Purple Sea has an average depth about 3 times as much. What is the average depth of the Purple Sea?

____

23. Iron melts at 1 535°C. The melting point of gold is 472°C less than the melting point of iron. Give this temperature.

24. Ann brought home 8 boxes of cherries. She said, "This is 10% of what I picked." How many boxes of cherries did Ann pick in all?

ANALYSIS

```
 _ZONE_ONE__PUPILS_IN_1978_AND_1979_ACHIEVING_WITHIN_EACH_CATAGCRY_A-D_
     CRITERION CATEGCRIES FOR     GRADE:6   STRAND:2   CEJECTIVE: 8
          TOTAL NUMBER OF PUPILS:  1978 N=1897    1979 N=1668

           A: BELOW 50%       B:  50-64%        C:  65-84%        D: 85-100%
        ____1978____1979_____1978____1979_____1978____1979_____1978____1979_
NUMBER(%)  41.49    36.21     33.00    31.41     12.23    14.39     13.28    17.59
MEAN (%)   23.00    22.79     56.05    56.49     75.00    75.00     92.41    92.25

           TABLES CCMPARING 1978 AND 1979 MEAN SCORES AND PROPORTICNS
   ___PROPORTION TEST___ #  ______________________F-TEST_____________________
   HO: PRCPOR78=PROPOR79 #  ________SS________  ______DF______
   _T-CALC____DF____PECB_#__BETWEEN______WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
A:    3.222  3563   0.001 #     15.52  254979.98    1      1369     0.085  0.771
B:    1.010  3563   0.313 #     54.78   44867.10    1      1148     1.402  0.237
C:   -1.898  3563   0.058 #  <<<<<<<<<<<<<< SSW IS EQUAL TC ZERO >>>>>>>>>>>>>>
D:   -3.872  3563   0.000 #      3.54   20435.49    1       550     0.095  0.758


   ______COMPARING_THE_MEAN_SCORES_OF_PUPILS_WITHIN_ZONE_SUBGROUPS_______
                               _____________________F-TEST TABLE_________________
GROUPS        YEARS        #   ________SS________  ______DF______
======_____1978____1979__#__BETWEEN______WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
EARLY        47.98    52.07 #   9341.37 1704782.52    1      2253    12.345  0.001
LATE         52.67    55.81 #   2862.97  824858.40    1      1157     4.016  0.045
MALE         49.97    53.05 #   4301.70 1363940.09    1      1823     5.750  0.017
FEMALE       48.97    53.72 #   9779.20 1285997.65    1      1738    13.216  0.000
NORTH        49.80    52.34 #   1546.93  718092.97    1       963     2.075  0.150
SOUTH        49.37    53.78 #  12552.27 1931749.11    1      2598    16.881  0.000
PUBLIC       49.64    52.87 #   7457.08 2147632.62    1      2873     9.976  0.002
SEPARATE     48.85    55.53 #   7663.23  800945.47    1       688    10.525  0.001
```

FIGURE 172

The proportion of pupils achieving in the 85-100 percent category for multiplying with one, two and three digit multipliers increased significantly in 1979. About one-third of the pupils in 1979 successfully answered all four multiplication items. An additional forty-five percent group achieved within categories B and C (50-84 percent), also for 1979.

Two thirds of the grade six pupils could divide at least two of the three division items (Figure 163).

One-half of the pupils were able to check multiplication solutions by division and vice versa to the 75 to 99 percent level. Another one pupil in five could check one of the two algorithms.

Two-thirds of the students achieved within categories C and D (65-100 percent) on the mental computation of simple addition, subtraction, multiplication and division problems.

Less than one-half of the pupils could solve two, three or all four of the test problems on multiplying and dividing decimals. Although there were some significant sub-group gains their mean scores ranged from 35 to 42 percent.

Significant improvement in the mastery of the basic facts was noted for 1979; still only one-half of the pupils scored to the 85 percent level. A further one-third of the grade six pupils had basic fact achievement within the 50-84 percent range.

The 1979 performance on problem-solving and estimating answers showed some gains over the 1978 figures. However, over two-thirds of the students were at or below the 64 percent level (Figure 172).

MEASUREMENT (Seven objectives; Figures 173 to 179)

Hypothesis 1

None of the objectives had performances where eighty percent of the Zone One pupils in 1978 and 1979 were in the 85-100 percent achievement category.

Hypothesis 2

Four objectives had significant increases in the proportion of pupils achieving at the 85-100 percent level in 1979 over 1978.

Findings

One-quarter of the pupils could not calculate the perimeter of the two quadrilaterals given in the test. Significantly more pupils in 1979 (36 percent compared to 30 percent) could solve both items, however.

Over one-half of the grade six pupils could not calculate the area of the triangle and quadrilateral using the formulae. Only one student in five achieved to the 100 percent level.

Performance on finding the volume of rectangular solids was slightly below that for area. Nearly sixty percent of the pupils could not calculate the volume for either of two solid figures when the dimensions were given.

Three items were included that requires the reading, translating, measuring or drawing of lengths to scale. While

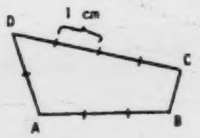
LEVEL F (Grade 6)

MEASUREMENT

OBJECTIVE 1 *Finds perimeter of polygons with and without formulae.*

TEST ITEMS

1. A. What is the perimeter of polygon ABCD?



____

B. A rectangle has a height of 5 m and a width 7 m. What is its perimeter?

____

ANALYSIS

```
 _ZONE_ONE__PUPILS_IN_1978_AND_1979_ACHIEVING_WITHIN_EACH_CATAGORY_A-D_
     CRITERION CATEGORIES FOR     GRADE:6   STRAND:3   OBJECTIVE: 1
          TOTAL NUMBER OF PUPILS:   1978 N=1897    1979 N=1668

          A: BELOW 50%       B:  50-64%       C:  65-84%       D: 85-100%
        ----1978____1979_____1978____1979_____1978____1979_____1978____1979_
NUMBER(%)  29.36    24.34    32.42    32.79     7.85     6.83    30.36   36.03
MEAN (%)    8.74     9.28    50.00    50.00    75.39    75.72   100.00  100.00

              TABLES COMPARING 1978 AND 1979 MEAN SCORES AND PROPORTIONS
   ___PROPORTION TEST___ #  ____________________F-TEST_____________________
   HO: PROPOR78=PROPOR79 #  _________SS________  ______DF______
   _T-CALC____DF____PROB_#__BETWEEN_____WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
A:    3.369   3563   0.001 #    68.53  208088.85     1        961     0.316  0.574
B:   -0.238   3563   0.812 #  <<<<<<<<<<<<<< SSW IS EQUAL TO ZERO >>>>>>>>>>>>>>
C:    1.162   3563   0.245 #     7.44   18180.14     1        261     0.107  0.744
D:   -3.590   3563   0.000 #  <<<<<<<<<<<<<< SSW IS EQUAL TO ZERO >>>>>>>>>>>>>>


   ------COMPARING_THE_MEAN_SCORES_OF_PUPILS_WITHIN_ZONE_SUBGROUPS_______
                                ____________________F-TEST TABLE_________________
GROUPS          YEARS        #  _________SS________  ______DF______
======_____1978____1979__#__BETWEEN_______WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
EARLY       53.31    58.38 #  14342.88 3001552.17     1        2253   10.766  0.001
LATE        59.66    61.79 #   1315.06 1547050.87     1        1157    0.984  0.322
MALE        56.01    59.35 #   5061.95 2391168.49     1        1823    3.859  0.050
FEMALE      54.06    60.40 #  17405.64 2357697.17     1        1738   12.831  0.000
NORTH       54.55    60.36 #   8119.97 1301797.70     1         963    6.007  0.014
SOUTH       55.24    59.67 #  12677.29 3448997.81     1        2598    9.549  0.002
PUBLIC      55.94    59.66 #   9900.86 3917439.63     1        2873    7.261  0.007
SEPARATE    51.40    60.70 #  14833.16  827276.75     1         688   12.336  0.000
```

FIGURE 173

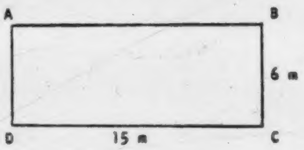
LEVEL F (Grade 6)

MEASUREMENT

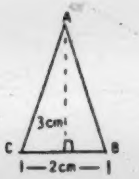
OBJECTIVE 2 *Finds area of triangles and quadrilaterals using formulae.*

TEST ITEMS

2. Find the area of rectangle ABCD.



3. Find the area of triangle ABC.



ANALYSIS

```
 _ZONE_ONE__PUPILS_IN_1978_AND_1979_ACHIEVING_WITHIN_EACH_CATAGORY_A-D_
      CRITERION CATEGORIES FOR     GRADE:6   STRAND:3   OBJECTIVE: 2
              TOTAL NUMBER OF PUPILS:  1978 N=1897    1979 N=1668

             A: BELOW 50%       B:  50-64%         C:  65-84%         D: 85-100%
         ____1978___1979_____1978____1979______1978____1979_____1978____1979_
NUMBER(%)  62.20    54.98     13.65    15.35     10.23     9.95     13.92   19.72
MEAN (%)   11.23    12.52     50.00    50.00     73.02    71.69    100.00  100.00

              TABLES COMPARING 1978 AND 1979 MEAN SCORES AND PROPORTIONS
   ___PROPORTION TEST___ #  __________________F-TEST____________________
   HO: PROPOR78=PROPOR79 #  ________SS________  ______DF______
   _T:CALC____DF____PROB_#__BETWEEN_____WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
A:   4.375   3563   0.000 #    863.89  528526.77     1     2095     3.424  0.064
B:  -1.436   3563   0.151 #  <<<<<<<<<<<<< SSW IS EQUAL TO ZERO >>>>>>>>>>>>>>
C:   0.272   3563   0.786 #    159.98   22420.27     1      358     2.555  0.111
D:  -4.646   3563   0.000 #  <<<<<<<<<<<<< SSW IS EQUAL TO ZERO >>>>>>>>>>>>>>


   ______COMPARING_THE_MEAN_SCORES_OF_PUPILS_WITHIN_ZONE_SUBGROUPS_______
                                 __________________F-TEST TABLE__________________
GROUPS          YEARS        #   ________SS________  ______DF______
******_____1978____1979__#__BETWEEN_____WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
EARLY       34.30    39.97 #  17853.56 2927874.94     1      2253    13.738  0.000
LATE        37.49    45.59 #  18978.99 1609808.76     1      1157    13.641  0.000
MALE        34.84    40.40 #  14014.31 2451689.50     1      1823    10.421  0.001
FEMALE      35.57    42.48 #  20712.42 2283721.81     1      1738    15.763  0.000
NORTH       37.59    37.83 #     13.33 1316283.73     1       963     0.010  0.921
SOUTH       34.33    42.78 #  46256.92 3409061.03     1      2598    35.252  0.000
PUBLIC      36.68    40.65 #  11248.84 3790837.73     1      2873     8.525  0.004
SEPARATE    29.04    44.65 #  41828.26  925136.71     1       688    31.107  0.000
```

FIGURE 174

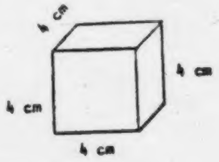
LEVEL F (Grade 6)

MEASUREMENT

OBJECTIVE 3 *Finds volume of rectangular solids using formulae.*

TEST ITEMS

4. Find the volume of a cube with sides of 4 cm.



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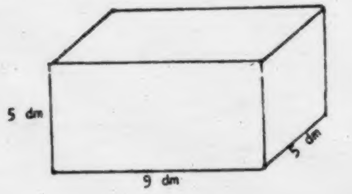
5. Find the volume of the rectangular solid shown in the diagram.



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ANALYSIS

```
            PUPILS IN 1978 AND 1979 ACHIEVING WITHIN EACH CATAGORY A-D
 ZONE ONE
      CRITERION CATEGORIES FOR     GRADE:6    STRAND:3    OBJECTIVE: 3
            TOTAL NUMBER OF PUPILS:   1978 N=1897    1979 N=1668

                                                                   D: 85-100%
                                                  C:  65-84%     1978     1979
             A: BELOW 50%       B:  50-64%       1978    1979    15.39    17.81
            1978     1979      1978     1979      8.70   10.97   100.00   100.00
NUMBER(%)   65.16    58.81     10.75    12.41    72.02    71.31
MEAN (%)     6.14     8.02     50.00    50.00

          TABLES COMPARING 1978 AND 1979 MEAN SCORES AND PROPORTIONS
                                                   F-TEST
    PROPORTION TEST     #                                   DF
  HO: PROPOR78=PROPOR79 #             SS                                 F-RATIO   PROB
   T-CALC     DF    PROB #   BETWEEN      WITHIN     BETWEEN  WITHIN     10.669    0.001
A:    3.897   3563  0.000 #    1940.53  402890.32        1      2215
B:   -1.545   3563  0.123 #  <<<<<<<<<<<<<< SSW IS EQUAL TO ZERO >>>>>>>>>>>>>>
C:   -2.282   3563  0.023 #      43.58   20211.85        1       346      0.746    0.388
D:   -1.936   3563  0.053 #  <<<<<<<<<<<<<< SSW IS EQUAL TO ZERO >>>>>>>>>>>>>>

                      COMPARING THE MEAN SCORES OF PUPILS WITHIN ZONE SUBGROUPS
                                                   F-TEST TABLE
                                                            DF
                   YEARS          #            SS                                F-RATIO   PROB
GROUPS                            #   BETWEEN      WITHIN    BETWEEN WITHIN      10.990    0.001
======          1978      1979    #   15472.26   3172008.15      1     2253       4.874    0.028
EARLY           29.83     35.10   #    7564.39   1795723.89      1     1157      14.059    0.000
LATE            34.81     39.92   #   20550.87   2664814.43      1     1823       5.428    0.020
MALE            30.83     37.56   #    7854.14   2514907.67      1     1738       1.014    0.314
FEMALE          31.24     35.50   #    1486.45   1411865.30      1      963      15.899    0.000
NORTH           30.96     33.44   #   28825.77   3763563.01      1     2598      10.966    0.001
SOUTH           31.06     37.73   #   16191.06   4242081.01      1     2873       9.607    0.002
PUBLIC          32.54     37.29   #   12816.01    917828.52      1      688
SEPARATE        24.80     33.44   #
```

FIGURE 175

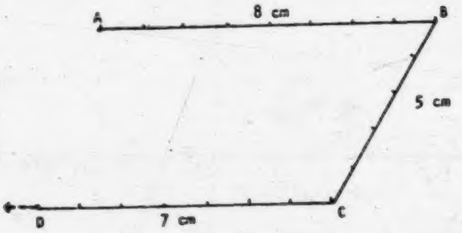
LEVEL F (Grade 6)

MEASUREMENT

OBJECTIVE 4 *Reads distances according to a scale.*

TEST ITEMS

6. If we use a scale of 1 cm = 1 km, how many kilometres shorter would it be directly from A to C than from A to C through B.



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ANALYSIS

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 _ZONE_ONE__PUPILS_IN_1978_AND_1979_ACHIEVING_WITHIN_EACH_CATAGCRY_A-D_
      CRITERION CATEGORIES FOR     GRADE:6   STRAND:3   CEJECTIVE: 4
           TOTAL NUMBER OF PUPILS:  1978 N=1897    1979 N=1668

           A: BELOW 50%       B:  50-64%         C:  65-84%         D: 85-100%
       ____1978____1979_____1978____1979_____1978____1979_____1978____1979_
NUMBER(%)  59.30    53.24     1.48     1.26      8.91     9.29     30.31    36.21
MEAN (%)    0.34     1.13    60.00    60.00     80.00    80.00    100.00   100.00

            TABLES CCMPARING 1978 AND 1979 MEAN SCORES AND PROPORTIONS
   ___PROPORTION TEST___ #  ____________________F-TEST_________________________
   HC: PRCPOR78=PROPOR79 #  _________SS________  ______DF______
   _T-CALC____DF____PROB_#__BETWEEN_____WITHIN__BETWEEN_WITHIN__F-RATIC__PRCB
A:    3.645   3563   0.000 #   308.43   51945.52    1      2011    11.940  0.001
B:    0.555   3563   0.579 #  <<<<<<<<<<<<<< SSW IS EQUAL TC ZERO >>>>>>>>>>>>>>
C:   -0.398   3563   0.691 #  <<<<<<<<<<<<<< SSW IS EQUAL TO ZERC >>>>>>>>>>>>>>
D:   -3.736   3563   0.000 #  <<<<<<<<<<<<<< SSW IS EQUAL TC ZERO >>>>>>>>>>>>>>


   ______COMPARING_THE_MEAN_SCORES_OF_PUPILS_WITHIN_ZONE_SUBGROUPS_______
                                ____________________F-TEST TABLE_________________
GROUPS        YEARS        #  _________SS________  ______DF______
======_____1978____1979__#__BETWEEN_____WITHIN__BETWEEN_WITHIN__F-RATIC__PRCB
EARLY       36.84    42.28 #  16442.08 4904706.30    1      2253     7.553  C.C06
LATE        42.19    49.86 #  17055.66 2626588.17    1      1157     7.513  0.006
MALE        38.71    44.95 #  17732.66 4029466.47    1      1823     8.023  0.C05
FEMALE      38.33    45.05 #  19543.11 3870631.37    1      1738     8.775  0.003
NORTH       34.38    42.52 #  15971.94 2037103.30    1       963     7.550  0.006
SOUTH       40.03    45.94 #  22627.59 5847323.02    1      2598    10.054  0.002
PUBLIC      38.52    44.68 #  27131.07 6355991.85    1      2873    12.264  0.001
SEPARATE    38.54    46.36 #  10493.86 1843446.27    1       688     4.678  0.031
```

FIGURE 176

LEVEL F (Grade 6)

MEASUREMENT

OBJECTIVE 5 *Draws diagrams according to a scale.*

TEST ITEMS

7. Draw a diagram of a rectangular parking lot of length 125 m and width 50 m using a scale of 1 m : 1 mm .

8. A house is designed with an L - shaped living/dining room. The living room has a length of 8 m and width of 4 m; the dining room has all sides equal to 3 m. Draw a diagram of this part of the house using a scale of 1 m : 1 cm.

ANALYSIS

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                ZONE ONE  PUPILS IN 1978 AND 1979 ACHIEVING WITHIN EACH CATAGORY A-D
             CRITERION CATEGCRIES FOR    GRADE:6   STRAND:3   CEJECTIVE: 5
                 TOTAL NUMBER OF PUPILS:  1978 N=1897   1979 N=1668

                                                      C:  65-84%        D: 85-100%
               A: BELOW 50%      B:  50-64%
                                                  1978    1979        1978    1979
            ____1978____1979_____1978____1979_____  3.48    3.78       33.95   35.07
NUMBER(%)   30.94   26.14     31.63   35.01        74.75   75.66      100.00  100.0C
MEAN (%)     2.27    3.44     50.00   50.0C

               TABLES CCMPARING 1978 AND 1979 MEAN SCCRES AND PROPCRTICNS
                                     #  ____________________F-TEST_____________________
   ___PROPORTION TEST___             # __________________    ______DF______
   HO: PROPOR78=PROPOR79             # ________SS________    BETWEEN WITHIN  F-RATIO  PROB
   _T-CALC____DF____PROB_            #  BETWEEN     WITHIN        1      1021     4.679  0.031
A:    3.164   3563    0.002          #    341.84    74588.65
B:   -2.140   3563    0.032          # <<<<<<<<<<<<<< SSW IS EQUAL TC ZERO >>>>>>>>>>>>>>
C:   -0.475   3563    0.635          #    26.92      8926.57     1       127     0.383  0.537
D:   -0.704   3563    0.481          # <<<<<<<<<<<<<< SSW IS EQUAL TO ZERO >>>>>>>>>>>>>>

      ______CCMPARING THE MEAN SCORES CF PUPILS WITHIN ZONE SUBGROUPS_______
                                   ____________________F-TEST TABLE___________________
                                   #  ________SS________     ______DF______
GROUPS          YEARS              #  BETWEEN      WITHIN    BETWEEN WITHIN  F-RATIO  PROB
======______1978____1979____       #                               1      2253     4.823  0.028
EARLY         51.31    54.97       #   7422.34  3467329.57      1      1157     1.979  0.160
LATE          56.67    59.87       #   2977.12  1740279.52      1      1823     3.860  0.050
MALE          53.94    57.55       #   5923.55  2797431.70      1      1738     2.436  0.119
FEMALE        52.15    55.07       #   3691.90  2633972.69      1       963     0.428  0.513
NORTH         54.85    53.19       #    665.81  1499270.87      1      2598    11.190  0.001
SOUTH         52.42    57.53       #  16917.82  3927750.56      1      2873     0.866  0.352
PUBLIC        54.37    55.73       #   1314.16  4361560.62      1       688    14.072  0.000
SEPARATE      47.65    58.88       #  21638.38  1057938.51      1
```

FIGURE 177

LEVEL F (Grade 6)

MEASUREMENT

OBJECTIVE 6 *Knows interrelationships among units of length, capacity, and mass.*

TEST ITEMS

9. Complete the chart to make the units between measures relate.

Length, Of One Side	Area of One Face	Volume of Cube	Capacity if cube is filled with water	Mass of capacity of water
________	→ 1 cm^2	→ 1 cm^3	→ 1 ml	→ ________
________	→ 1 dm^2	→ 1 dm^3	→ ______	→ ________
________	→ 1 m^2	→ 1 m^3	→ ______	→ ________

ANALYSIS

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 ZONE ONE  PUPILS IN 1978 AND 1979 ACHIEVING WITHIN EACH CATAGCRY A-D
      CRITERION CATEGORIES FOR      GRADE:6    STRAND:3    OEJECTIVE: 6
           TOTAL NUMBER OF PUPILS:  1978 N=1897    1979 N=1668

          A: BELOW 50%       B:  50-64%        C:  65-84%        D: 85-100%
      ____1978____1979_____1978____1979_____1978____1979_____1978____1979_
NUMBER(%)  78.76    72.90      9.70    13.43     3.00     3.78     8.54     9.89
MEAN (%)   12.79    14.74     54.28    54.41    75.00    75.00    97.07    97.88

           TABLES CCMPARING 1978 AND 1979 MEAN SCORES AND PROPORTIONS
   ___PROPORTION TEST___ #  ____________________F-TEST______________________
   HC: PRCPOR78=PROPOR79 #  _________SS_________  ______DF______
   _T-CALC____DF____PROB_#__BETWEEN______WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
A:   4.085   3563   0.000 #   2544.16  810796.53     1     2708     8.497  0.004
B:  -3.490   3563   0.001 #      1.67   14463.71     1      406     0.047  0.829
C:  -1.276   3563   0.202 #  <<<<<<<<<<<<<< SSW IS EQUAL TC ZERO >>>>>>>>>>>>>>
D:  -1.396   3563   0.163 #     53.75    8177.33     1      325     2.136  0.145


     _____CCMPARING THE MEAN SCORES OF PUPILS WITHIN ZONE SUBGROUPS______
                            ____________________F-TEST TABLE________________
GROUPS        YEARS       #  _________SS_________  ______DF______
======_____1978____1979__#__BETWEEN______WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
EARLY       24.74    27.81 #   5250.35 2107786.93     1      2253     5.612  0.018
LATE        28.80    35.80 #  14188.26 1238943.75     1      1157    13.250  0.000
MALE        27.12    30.49 #   5150.72 1841382.16     1      1823     5.099  0.024
FEMALE      24.58    30.65 #  15976.02 1655640.00     1      1738    16.771  0.000
NORTH       20.15    25.43 #   6726.98  815214.40     1       963     7.946  0.005
SOUTH       27.96    32.52 #  13444.63 2645506.76     1      2598    13.203  0.000
PUBLIC      27.78    29.54 #   2208.63 2845597.56     1      2873     2.230  0.136
SEPARATE    18.02    34.89 #  48851.25  618752.01     1       688    54.318  0.000
```

FIGURE 178

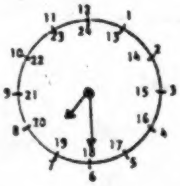
LEVEL F (Grade 6)

MEASUREMENT

OBJECTIVE 7 *Reads the 24 hour clock and writes corresponding time notation.*

TEST ITEMS

10. Using 24 hour notations, write the times for the clocks below. It is before midnight.


12
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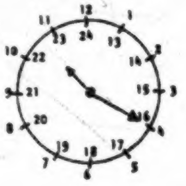
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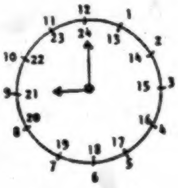
11. Circle the times the clocks show: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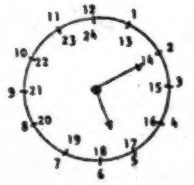
21
22
23

(a) 09 21 and 21 09
(b) 09 00 and 21 00
(c) 12 24 and 24 12
(d) 08 12 one 24 00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15
16
17
18
19
20
21
22
23

(a) 14 20 and 17 05
(b) 05 14 and 05 02
(c) 05 10 and 17 10
(d) 17 05 and 14 10

ANALYSIS

```
 ZONE ONE  PUPILS IN 1978 AND 1979 ACHIEVING WITHIN EACH CATAGCRY A-D
      CRITERION CATEGCRIES FOR     CRADE:6   STRAND:3   OEJECTIVE: 7
            TOTAL NUMBER OF PUPILS:  1978 N=1897   1979 N=1668

              A: BELOW 50%         B:  50-64%        C:  65-84%        D: 85-100%
          ____1978____1979_____1978____1979_____1978____1979_____1978____1979_
NUMBER(%)   42.01     32.85     22.72    26.20     10.96     9.89     24.30    31.06
MEAN (%)    10.98     10.72     50.03    50.11     75.00    75.00     99.81    99.90

            TABLES CCMPARING 1978 AND 1979 MEAN SCORES AND PROPCRTIONS
   ___PROPORTION TEST___ #  ____________________F-TEST______________________
   HC: PRCPOR78=PROPOR79 #  ________SS________  ______DF______
   _T-CALC____DF____PROB_#__BETWEEN______WITHIN__BETWEEN_WITHIN__F-RATIC__PROB
A:    5.630   3563   0.000 #      21.59  208764.42     1       1343     0.139  0.709
B:   -2.415   3563   0.016 #       1.58     775.17     1        866     1.769  0.184
C:    1.044   3563   0.297 #  <<<<<<<<<<<<< SSW IS EQUAL TO ZERO >>>>>>>>>>>>>>
D:   -4.508   3563   0.000 #       2.12    1697.32     1        977     1.222  0.269

      ______COMPARING THE MEAN SCORES OF PUPILS WITHIN ZONE SUBGROUPS_______
                            ____________________F-TEST TABLE_________________
                            ________SS________  ______DF______
GROUPS          YEARS     #  ________SS________
======______1978____1979__#__BETWEEN______WITHIN__BETWEEN_WITHIN__F-RATIC__PROB
EARLY        47.99    54.45 #  23239.39 3084492.32     1      2253    16.975  0.000
LATE         49.66    57.47 #  17678.33 1598999.84     1      1157    12.792  0.000
MALE         50.01    55.87 #  15575.67 2455813.37     1      1823    11.562  0.001
FEMALE       46.82    54.29 #  24169.06 2427680.35     1      1738    17.303  0.000
NORTH        50.72    56.82 #   8965.71 1315214.99     1       963     6.565  0.011
SOUTH        47.64    54.44 #  29913.08 3568743.41     1      2598    21.776  0.000
PUBLIC       49.27    54.70 #  21131.42 3985622.71     1      2873    15.232  0.000
SEPARATE     45.09    56.74 #  23293.87  897466.39     1       688    17.857  0.000
```

FIGURE 179

over fifty percent of the pupils in 1979 could not use a scale (1 cm=1 km) to find a specified distance, three-quarters of the students succeeded in drawing at least one of two diagrams to scale.

The achievement means on the test item which measured the knowledge students had of the interrelationships among the metric units of length, capacity and mass were low. Only ten percent of the Zone One population scored at the 85-100 percent level.

Slightly less than one-third of the students in 1979, significantly more than in 1978, could read all four of the 24-hour clocks.

GEOMETRY (Three objectives; Figures 180-182)

Hypothesis 1

None of the objectives had performances where eighty percent of the Zone One pupils in 1978 and 1979 were in the 85-100 percent achievement level.

Hypothesis 2

All three objectives had significant increases in the proportion of pupils achieving at the 85-100 percent level in 1979 over 1978.

Findings

Two-thirds of the grade six pupils could identify at least four of the following terms: line, line segment, ray, intersecting lines, parallel lines, and perpendicular lines. One-half of the pupils in 1979 could perform a majority of

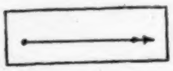
LEVEL F (Grade 6)

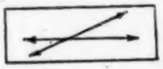
GEOMETRY

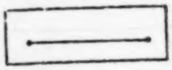
OBJECTIVE I *Identifies and names lines, line segments, rays, intersecting lines, parallel lines, perpendicular lines.*

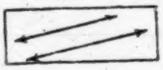
TEST ITEMS

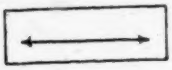
12. In each box below there is a different type of line. Write the name on the blank. You may choose from these answers: line, intersecting lines, ray, line segment, parallel lines, perpendicular line.

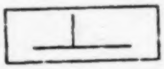
 ________

 ________

 ________

 ________

 ________

 ________

ANALYSIS

```
 _ZONE_ONE__PUPILS_IN_1978_AND_1979_ACHIEVING_WITHIN_EACH_CATAGCRY_A-D_
    CRITERION CATEGCRIES FOR     GRADE:6   STRAND:4   OBJECTIVE: 1
          TOTAL NUMBER OF PUPILS:  1978 N=1897    1979 N=1668

           A: BELOW 50%       B:  50-64%        C:  65-84%        D: 85-100%
          ____1978____1979_____1978____1979_____1978____1979_____1978____1979_
NUMBER(%)  27.52    21.88      16.76    12.95     23.46    26.92     32.26   38.25
MEAN (%)   18.14    16.42      50.05    50.00     69.08    68.97     99.97  100.00

             TABLES CCMPARING 1978 AND 1979 MEAN SCORES AND PROPORTIONS
   ___PROPORTION TEST___ #  ____________________F-TEST______________________
   HO: PRCPOR78=PROPOR79 #  _________SS________  ______DF______
   _T-CALC____DF____PRCB_#__BETWEEN_____WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
A:    3.883  3563   0.000 #    635.36  184614.86    1      885    3.046  0.081
B:    3.184  3563   0.002 #      0.35     138.02    1      532    1.362  0.244
C:   -2.378  3563   0.017 #      2.92   30094.41    1      892    0.087  0.769
D:   -3.739  3563   0.000 #      0.23     138.44    1     1248    2.088  0.149

     ______CCMPARING_THE_MEAN_SCORES_OF_PUPILS_WITHIN_ZONE_SUBGROUPS_______
                              ___________________F-TEST TABLE________________
GROUPS          YEARS       #  _________SS________  ______DF______
======_____1978____1979__#__BETWEEN_____WITHIN__BETWEEN_WITHIN__F-RATIC__PRCB
EARLY      60.39    65.86 #  16671.74 2506979.90    1     2253   14.983  0.000
LATE       64.77    69.89 #   7587.77 1179507.07    1     1157    7.443  0.007
MALE       62.01    67.19 #  12222.84 1954057.60    1     1823   11.174  0.001
FEMALE     61.66    66.55 #  10374.72 1868089.68    1     1738    9.652  0.002
NORTH      53.40    63.68 #  25430.55 1138040.52    1      963   21.519  0.000
SOUTH      64.90    68.10 #   6626.48 2668796.35    1     2598    6.451  0.011
PUBLIC     62.56    66.26 #   9824.79 3132068.35    1     2873    9.012  0.003
SEPARATE   58.85    69.47 #  19362.59  723587.64    1      688   18.402  0.000
```

FIGURE 180

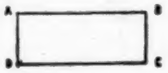
LEVEL F (Grade 6)

GEOMETRY

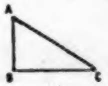
OBJECTIVE 2 *Translates, rotates, reflects, and enlarges 2-dimensional figures.*

TEST ITEMS

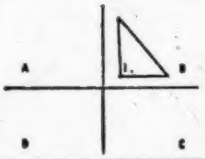
13. Rotate clockwise rectangle ABCD one quarter turn around point A. Draw the result.



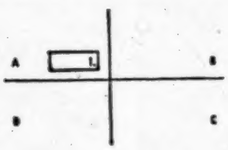
14. Rotate Δ ABC one half turn around point B. Draw the result.



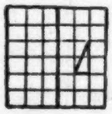
15. Translate the triangle from quadrant B to quadrant D. Draw the result.



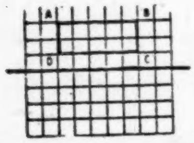
16. Translate the rectangle from quadrant A to B. Draw the result.



17. Draw a reflection for this triangle.



18. Draw a reflection for this rectangle ABCD.



ANALYSIS

```
 _ZONE_ONE__PUPILS_IN_1978_AND_1979_ACHIEVING_WITHIN_EACH_CATAGCRY_A=D_
      CRITERION CATEGORIES FOR     GRADE:6   STRAND:4   CEJECTIVE: 2
           TOTAL NUMBER OF PUPILS:  1978 N=1897    1979 N=1668

           A: BELOW 50%       B:  50-64%        C:  65-84%        D: 85-100%
       ____1978____1979_____1978____1979_____1978____1979_____1978____1979_
NUMBER(%)  38.64    27.46     26.04    21.04     27.62    39.57     7.70    11.93
MEAN (%)   27.44    25.86     53.34    52.97     73.14    74.18    98.86    98.62

            TABLES CCMPARING 1978 AND 1979 MEAN SCORES AND PROPORTIONS
  ___PROPCRTION TEST___ #  ___________________F-TEST_______________________
  HO: PRCPOR78=PROPOR79 #  _________SS_________  ______DF______
  _T-CALC____DF____PROB_#__BETWEEN_____WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
A:   7.063  3563   0.000 #    711.83  228619.03    1       1189     3.702  0.055
B:   3.501  3563   0.000 #     28.45   13828.06    1        843     1.735  0.188
C:  -7.557  3563   0.000 #    315.92   70657.95    1       1182     5.285  0.022
D:  -4.267  3563   0.000 #      4.87    3110.27    1        343     0.537  0.464


  ______CCMPARING_THE_MEAN_SCORES_OF_PUPILS_WITHIN_ZONE_SUBGRCUPS_______
                                   ___________________F-TEST TABLE_________________
GROUPS        YEARS        #   _________SS_________  ______DF______
======______1978____1979__#__BETWEEN_____WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
EARLY        50.95   58.55 #  32149.74 1492640.97    1       2253    48.527  0.000
LATE         55.41   61.29 #  10023.51  715601.43    1       1157    16.206  0.000
MALE         53.24   60.23 #  22216.15 1254095.65    1       1823    32.294  0.000
FEMALE       51.33   58.46 #  22029.63 1036627.58    1       1738    36.935  0.000
NORTH        46.49   57.03 #  26762.04  638186.86    1        963    40.383  0.000
SOUTH        54.42   60.25 #  22004.77 1628802.50    1       2598    35.098  0.000
PUBLIC       52.51   57.93 #  20959.57 1893797.34    1       2873    31.797  0.000
SEPARATE     51.45   65.39 #  33402.90  385168.05    1        688    59.665  0.000
```

FIGURE 181.

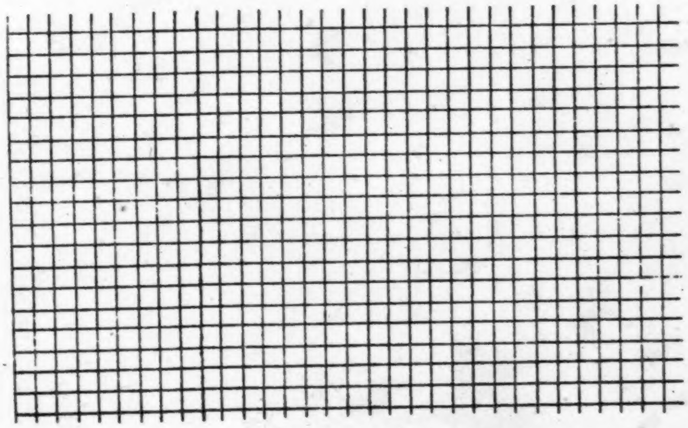
LEVEL F (Grade 6)

GEOMETRY

OBJECTIVE 3 *Constructs 3-dimensional objects.*

TEST ITEMS

19. Draw a diagram that could be cut out and assembled into the shape of a cube.



ANALYSIS

```
 _ZCNE_ONE__PUPILS_IN_1978_AND_1979_ACHIEVING_WITHIN_EACH_CATAGCRY_A-D_
      CRITERION CATEGCRIES FOR     GRADE:6   STRAND:4   OBJECTIVE: 3
            TOTAL NUMBER OF PUPILS:  1978 N=1897    1979 N=1668

          A: BELOW 50%        B:  50-64%         C:  65-84%         D: 85-100%
      ____1978____1979______1978____1979_____1978____1979_____1978____1979_
NUMBER(%)  55.46    49.34       1.27     1.44       2.69    1.80      40.59   47.42
MEAN (%)    0.65     1.41      50.35    50.00      77.94   78.61      99.99   99.58

            TABLES CCMPARING 1978 AND 1979 MEAN SCCRES AND PROPORTIONS
    ___PROPORTION TEST___ #  ____________________F-TEST________________________
    HC: PRCPOR78=PROPCR79 #  ________SS________   ______DF______
    _T-CALC____DF____PROB_#__BETWEEN______WITHIN__BETWEEN_WITHIN__F-RATIC__PROB
A:   3.649   3563   0.000 #    265.24    42717.50     1       1873   11.630   0.001
B:  -0.449   3563   0.654 #      1.45       66.55     1         46    1.000   0.323
C:   1.779   3563   0.075 #      8.48     4514.84     1         79    0.148   0.701
D:  -4.102   3563   0.000 #      0.04      207.89     1       1559    0.307   0.579


     ______CCMPARING_THE_MEAN_SCORES_OF_PUPILS_WITHIN_ZONE_SUBGROUPS_______
                                  ___________________F-TEST TABLE__________________
GROUPS          YEARS        #    ________SS________   ______DF______
======_____1978_____1979__#__BETWEEN_____WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
EARLY       42.54     48.67 #  20868.80 5344758.08    1       2253     8.797   0.003
LATE        44.94     53.37 #  20565.55 2768736.29    1       1157     8.594   0.003
MALE        44.96     52.01 #  22574.66 4318203.27    1       1823     9.530   0.002
FEMALE      42.33     48.40 #  15926.86 4114504.62    1       1738     6.728   0.010
NORTH       45.21     53.62 #  17020.65 2246007.56    1        963     7.298   0.007
SOUTH       43.12     48.95 #  21982.34 6186489.86    1       2598     9.231   0.002
PUBLIC      45.10     48.73 #   9397.18 6774773.93    1       2873     3.985   0.046
SEPARATE    37.78     56.59 #  60748.78 1634641.81    1        688    25.568   0.000
```

FIGURE 132

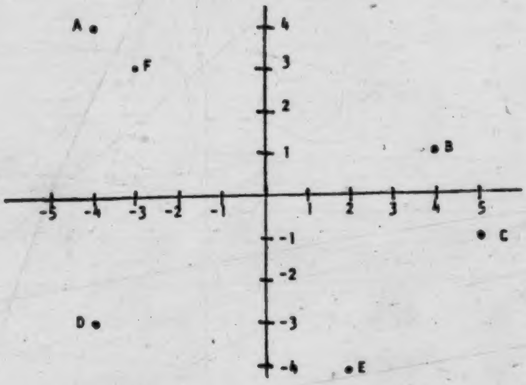
LEVEL F (Grade 6)

GRAPHING

OBJECTIVE 1 *Locates points in all four quadrants.*

TEST ITEMS

20. Name the letters that show where (-4, -3), (4, 1), (2, -4), and (-3, 3) are located.



(- 4, -3) ____________

(4, 1) ____________

(2, -4) ____________

(-3, 3) ____________

ANALYSIS

```
 _ZONE_ONE__PUPILS_IN_1978_AND_1979_ACHIEVING_WITHIN_EACH_CATAGORY_A-D_
      CRITERION CATEGORIES FOR     GRADE:6   STRAND:5   OBJECTIVE: 1
           TOTAL NUMBER OF PUPILS:  1978 N=1897    1979 N=1668

          A: BELOW 50%       B:  50-64%        C:  65-84%       D: 85-100%
      ____1978____1979_____1978____1979_____1978____1979_____1978____1979_
NUMBER(%)  23.19   12.59     5.32    3.06     5.96    5.70    65.52   78.66
MEAN (X)    5.83    5.87    50.00   50.16    75.44   75.35    99.99   99.99

          TABLES COMPARING 1978 AND 1979 MEAN SCORES AND PROPORTIONS
   ___PROPORTION TEST___ #  ___________________F-TEST______________________
   HO: PROPOR78=PROPOR79 #  ________SS________  ______DF______
   _T-CALC____DF____PROB_#__BETWEEN_____WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
A:   8.182  3563   0.000 #      0.22   72923.28     1      648    0.002  0.964
B:  *3.342  3563   0.001 #      0.90      68.08     1      150    1.993  0.160
C:   0.332  3563   0.740 #      0.43    1077.29     1      206    0.083  0.774
D:  -8.683  3563   0.000 #      0.03     208.06     1     2553    0.390  0.532

   _____COMPARING_THE_MEAN_SCORES_OF_PUPILS_WITHIN_ZONE_SUBGROUPS______
                            ___________________F-TEST TABLE_________________
GROUPS        YEARS       #  ________SS________  ______DF______
======______1978____1979__#__BETWEEN_____WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
EARLY       73.54   84.92 #  72148.29 3068191.20     1     2253   52.979  0.000
LATE        76.18   86.38 #  30141.56 1410582.96     1     1157   24.723  0.000
MALE        73.37   85.53 #  67181.56 2402949.95     1     1823   50.967  0.000
FEMALE      74.71   84.89 #  44855.45 2293095.70     1     1738   33.997  0.000
NORTH       74.21   85.00 #  28037.04 1279516.50     1      963   21.101  0.000
SOUTH       73.96   85.30 #  83184.06 3417500.75     1     2598   63.237  0.000
PUBLIC      74.79   84.14 #  62516.71 3831840.87     1     2873   46.873  0.000
SEPARATE    70.84   89.75 #  61326.77  852443.76     1      688   49.496  0.000
```

FIGURE 183

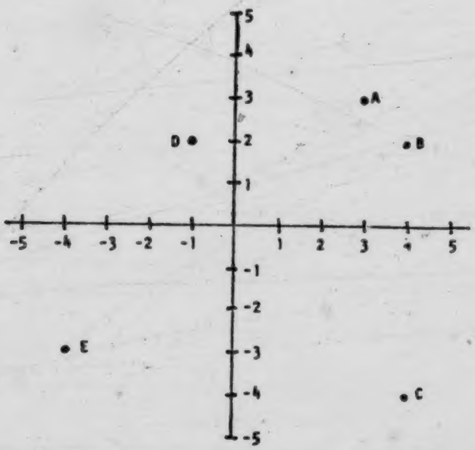
LEVEL F (Grade 6)

GRAPHING

OBJECTIVE 2 *Generates ordered pairs from a given relationship involving integers.*

TEST ITEMS

21. Give the coordinates for points



A. ____________

B. ____________

C. ____________

D. ____________

E. ____________

ANALYSIS

```
 _ZONE_ONE__PUPILS_IN_1978_AND_1979_ACHIEVING_WITHIN_EACH_CATAGCEY_A-D_
      CRITERICN CATEGCRIES FOR     GRADE:6   STRAND:5   CEJECTIVE: 2
           TOTAL NUMBER OF PUPILS:  1978 N=1897   1979 N=1668

           A: BELOW 50%        B:  50-64%        C:  65-84%        D: 85-100%
       ____1978____1979_____1978____1979_____1978____1979_____1978____1979_
NUMBER(%)  32.79    22.54     8.43     9.23     29.41    31.53    29.36    36.69
MEAN (%)   11.29    13.21    50.21    50.22     76.91    77.01    99.87    99.84

           TABLES CCMPARING 1978 AND 1979 MEAN SCGRES AND PROPCRTICNS
   ___PFOPORTION TEST___ #  ____________________F-TEST_____________________
   HO: PRCPOR78=PFOPOR79 #  ________SS________   ______DF______
   _T=CALC____DF____PRCB_#__BETWEEN_____WITHIN__BETWEEN_WITHIN__F=RATIC__PRCB
A:   6.799   3563   0.000 #   859.39  217066.26    1       996    3.943   0.047
B:  -0.839   3563   0.402 #     0.01     541.40    1       312    0.003   0.957
C:  -1.373   3563   0.170 #     2.73   69789.90    1      1082    0.042   0.837
D:  -4.651   3563   0.000 #     0.24    1431.89    1      1167    0.196   0.658

   ------CCMPARING_THE_MEAN_SCORES_CF_PUPILS_WITHIN_ZONE_SUBGROUPS_______
                                 ____________________F-TEST TABLE__________________
GROUPS         YEARS        #  ________SS________   ______DF______
======_____1978____1979__#__BETWEEN_____WITHIN__BETWEEN_WITHIN__F=RATIC__PROB
EARLY      58.49   67.78 #  48107.06 3030598.78    1      2253   35.764  0.000
LATE       62.48   71.41 #  23132.06 1449094.35    1      1157   18.469  0.000
MALE       59.60   68.09 #  32771.21 2373921.49    1      1823   25.166  0.000
FEMALE     60.18   68.98 #  33577.27 2290095.15    1      1738   25.482  0.000
NORTH      58.07   65.83 #  14510.95 1369645.35    1       963   10.203  0.001
SOUTH      60.54   69.56 #  52557.98 3287975.78    1      2598   41.529  0.000
PUBLIC     61.47   67.56 #  26489.03 3749824.65    1      2873   20.295  0.000
SEPARATE   53.30   72.61 #  84039.23  888186.10    1       688   49.606  0.000
```

FIGURE 184

the translations, rotations and reflections required in transformational geometry.

About fifty percent of the pupils could draw a figure that when cut out would form a 3-dimensional cube.

GRAPHING (Two objectives; Figures 183 and 184)

Hypothesis 1

Neither of the objectives had performances where eighty percent of the Zone One pupils in 1978 and 1979 were in the 85-100 percent achievement category.

Hypothesis 2

Both objectives had significant increases in the proportion of pupils achieving to the 85-100 percent category in 1979 over 1978.

Findings

Almost eighty percent of the students could use ordered pairs to locate points in all four quadrants. However, only thirty-six percent of the pupils could give the coordinates for points located within the four quadrants with 100 percent accuracy. An additional forty percent of the students give the coordinates in one-half to four-fifths of the test examples.

A. DISCUSSION OF THE GRADE SIX RESULTS

The accumulative data from the Zone One elementary mathematics tests does not reflect a success oriented program. Indeed the results from the grade six tests summarized in Tables 20, 21 and 22, are somewhat representative of Dividion II (Grades 4, 5, 6) and lower than one might hope for.

Number

The grade six number performance was significantly better 1979.

One of the two new topics offered at this level is that of integers and students did reasonably well with them. The other new topic, percent, calls for the use of decimal fractions to express and solve for percent. However two of the six items referenced to the objective involve common fractions. In addition most of the decimal forms are of the tricky variety and so the scores for percent are likely distorted.

The place value items continue to cause many children problems.

The low achievement figures for the objective involving the expressing of halves, quarters and fifths as fractions or decimals is somewhat surprising. Grade five students did better on what appears to be a more difficult item. The problems however may still lie with decimals. The data in Figures 160 and 161 add support to this notion.

The evidence or proportional ratios for up to and including grade six indicates that students may have difficulty with the format of the problems.

Operations and Properties

The items used to test the pupils use of the whole

TABLE 21

ACHIEVEMENT MEANS IN 1978 AND 1979 WITHIN CATEGORIES A-D FOR THE NUMBER, OPERATIONS AND PROPERTIES, AND MEASUREMENT STRANDS

```
   _ZONE_ONE__PUPILS_IN_1978_AND_1979_ACHIEVING_WITHIN_EACH_CATAGORY_A-D_
       CRITERION CATEGORIES FOR  GRADE:6  STRAND: NUMBER
            TOTAL NUMBER OF PUPILS:  1978 N=1897    1979 N=1668

           A: BELOW 50%       B:  50-64%        C:  65-84%        D: 85-100%
       ____1978____1979_____1978____1979_____1978____1979_____1978____1979_
NUMBER(%)  48.60    33.57    16.08    16.79    21.82    27.16    13.49    22.48
MEAN (%)   28.30    30.70    56.91    57.48    73.65    74.76    91.88    92.50

             TABLES COMPARING 1978 AND 1979 MEAN SCORES AND PROPORTIONS
   ___PROPORTION TEST___ #  ____________________F-TEST_______________________
   HO: PROPOR78=PROPOR79 #  ________SS________  ______DF______
   _T-CALC____DF____PROB_#__BETWEEN_____WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
A:    9.086  3563   0.000 #   2013.11  270988.55     1       1460   10.995  0.001
B:   -0.570  3563   0.569 #     47.50   11066.32     1        583    2.502  0.114
C:   -3.704  3563   0.000 #    265.64   27442.25     1        865    8.373  0.004
D:   -7.015  3563   0.000 #     58.32   14817.40     1        629    2.476  0.116

   _ZONE_ONE__PUPILS_IN_1978_AND_1979_ACHIEVING_WITHIN_EACH_CATAGORY_A-D_
       CRITERION CATEGORIES FOR  GRADE:6  STRAND: OPERATIONS & PROPERTIES
            TOTAL NUMBER OF PUPILS:  1978 N=1897    1979 N=1668

           A: BELOW 50%       B:  50-64%        C:  65-84%        D: 85-100%
       ____1978____1979_____1978____1979_____1978____1979_____1978____1979_
NUMBER(%)  32.63    26.68    21.24    21.10    34.21    36.69    11.91    15.53
MEAN (%)   31.95    31.94    57.77    57.81    74.39    74.58    90.32    89.78

             TABLES COMPARING 1978 AND 1979 MEAN SCORES AND PROPORTIONS
   ___PROPORTION TEST___ #  ____________________F-TEST_______________________
   HO: PROPOR78=PROPOR79 #  ________SS________  ______DF______
   _T-CALC____DF____PROB_#__BETWEEN_____WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
A:    3.875  3563   0.000 #      0.08  186295.51     1       1062    0.000  0.983
B:    0.103  3563   0.918 #      0.33   13337.57     1        753    0.019  0.892
C:   -1.845  3563   0.123 #     11.51   42286.12     1       1259    0.343  0.558
D:   -3.141  3563   0.002 #     34.27    7686.90     1        483    2.153  0.143

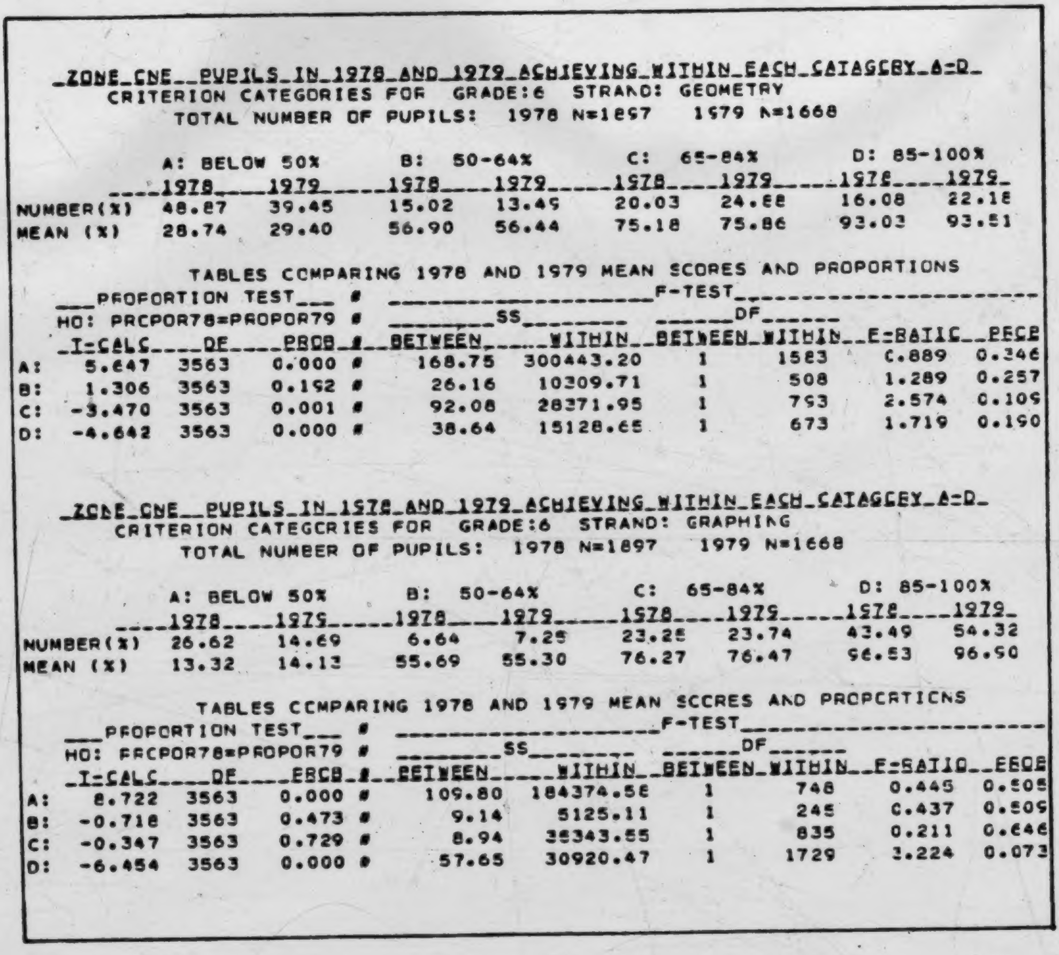
   _ZONE_ONE__PUPILS_IN_1978_AND_1979_ACHIEVING_WITHIN_EACH_CATAGORY_A-D_
       CRITERION CATEGORIES FOR  GRADE:6  STRAND: MEASUREMENT
            TOTAL NUMBER OF PUPILS:  1978 N=1897    1979 N=1668

           A: BELOW 50%       B:  50-64%        C:  65-84%        D: 85-100%
       ____1978____1979_____1978____1979_____1978____1979_____1978____1979_
NUMBER(%)  62.94    55.52    15.76    17.87    15.76    17.87     5.54     8.75
MEAN (%)   24.44    26.69    56.76    57.51    74.04    74.55    90.90    91.33

             TABLES COMPARING 1978 AND 1979 MEAN SCORES AND PROPORTIONS
   ___PROPORTION TEST___ #  ____________________F-TEST_______________________
   HO: PROPOR78=PROPOR79 #  ________SS________  ______DF______
   _T-CALC____DF____PROB_#__BETWEEN_____WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
A:    4.806  3563   0.000 #   2642.38  428059.74     1       2118   13.074  0.000
B:   -1.679  3563   0.094 #     83.99   11777.52     1        595    4.243  0.040
C:   -1.679  3563   0.094 #     37.57   19317.40     1        595    1.157  0.282
D:   -3.747  3563   0.000 #     11.00    5298.34     1        249    0.517  0.473
```

TABLE 22

ACHIEVEMENT MEANS IN 1978 AND 1979 WITHIN CATEGORIES A-D FOR THE GEOMETRY AND GRAPHING STRANDS



```
_ZONE_ONE__PUPILS_IN_1978_AND_1979_ACHIEVING_WITHIN_EACH_CATAGORY_A-D_
    CRITERION CATEGORIES FOR  GRADE:6  STRAND: GEOMETRY
          TOTAL NUMBER OF PUPILS:  1978 N=1897   1979 N=1668

          A: BELOW 50%       B:  50-64%        C:  65-84%        D: 85-100%
      ____1978____1979_____1978____1979_____1978____1979_____1978____1979_
NUMBER(%)  48.87    39.45     15.02    13.49     20.03    24.88     16.08    22.18
MEAN (%)   28.74    29.40     56.90    56.44     75.18    75.86     93.03    93.51

          TABLES COMPARING 1978 AND 1979 MEAN SCORES AND PROPORTIONS
   ___PROPORTION TEST___ #  ____________________F-TEST_______________________
   HO: PROPOR78=PROPOR79 #  _________SS_________  ______DF______
   _T-CALC____DF____PROB_#__BETWEEN______WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
A:   5.647   3563   0.000 #    168.75  300443.20     1      1583     0.889  0.346
B:   1.306   3563   0.192 #     26.16   10309.71     1       508     1.289  0.257
C:  -3.470   3563   0.001 #     92.08   28371.95     1       793     2.574  0.109
D:  -4.642   3563   0.000 #     38.64   15128.65     1       673     1.719  0.190


_ZONE_ONE__PUPILS_IN_1978_AND_1979_ACHIEVING_WITHIN_EACH_CATAGORY_A-D_
    CRITERION CATEGORIES FOR  GRADE:6  STRAND: GRAPHING
          TOTAL NUMBER OF PUPILS:  1978 N=1897   1979 N=1668

          A: BELOW 50%       B:  50-64%        C:  65-84%        D: 85-100%
      ____1978____1979_____1978____1979_____1978____1979_____1978____1979_
NUMBER(%)  26.62    14.69      6.64     7.25     23.25    23.74     43.49    54.32
MEAN (%)   13.32    14.13     55.69    55.30     76.27    76.47     96.53    96.50

          TABLES COMPARING 1978 AND 1979 MEAN SCORES AND PROPORTIONS
   ___PROPORTION TEST___ #  ____________________F-TEST_______________________
   HO: PROPOR78=PROPOR79 #  _________SS_________  ______DF______
   _T-CALC____DF____PROB_#__BETWEEN______WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
A:   8.722   3563   0.000 #    109.80  184374.58     1       748     0.445  0.505
B:  -0.718   3563   0.473 #      9.14    5125.11     1       245     0.437  0.509
C:  -0.347   3563   0.729 #      8.94   35343.55     1       835     0.211  0.646
D:  -6.454   3563   0.000 #     57.65   30920.47     1      1729     3.224  0.073
```

TABLE 20
THE 1978 AND 1979 ZONE ONE MEAN SCORES FOR GRADE SIX BY OBJECTIVES AND STRAND

ZONE ONE GRADE SIX JUNE/78

	NUMBER		OPERATIONS & PROPERTIES		MEASUREMENT		GEOMETRY		GRAPHING
1	49.8%	1	64.0%	1	55.1%	1	61.8%	1	74.0%
2	52.8%	2	69.7%	2	35.2%	2	52.3%	2	59.9%
3	40.1%	3	61.7%	3	31.0%	3	43.7%		
4	46.7%	4	55.9%	4	38.5				
5	75.4%	5	71.1%	5	53.1%				
6	47.5%	6	35.5%	6	25.9%				
		7	73.9%	7	48.5%				
		8	49.3%						
AVG	51.4%		58.9%		41.6%		52.6%		67.0%

ZONE ONE GRADE FIVE JUNE/79

	NUMBER		OPERATIONS & PROPERTIES		MEASUREMENT		GEOMETRY		GRAPHING
1	59.0%	1	65.9%	1	59.9%	1	66.9%	1	85.2%
2	62.2%	2	64.7%	2	41.4%	2	59.4%	2	68.5%
3	51.3%	3	64.7%	3	36.6%	3	50.2%		
4	58.2%	4	59.2%	4	45.0%				
5	81.8%	5	73.3%	5	56.3%				
6	56.5%	6	38.9%	6	30.6%				
7	58.4%	7	76.2%	7	55.1%				
		8	53.4%						
AVG	61.1%		62.0%		46.4%		58.8%		76.9%

number algorithms with the four operations appear overly difficult for the purpose intended. This criticism could apply to many of the test items in the assessment instruments, particularly in Division II. Division I items seem to be more carefully designed so as not to confuse the children, whereas the opposite may be an implicit procedure at the grade four, five and six levels.

Pupils in grade six still do not show mastery performances on the basic facts. Many factors such as the emphasis given to immediate recall by teachers or the lack of retention by pupils may be contributing to the problem.

Students coming to grade seven will have negligible skill with multiplying and dividing decimals. The same may be said for problem solving. The latter (problem solving) is perhaps of most concern particularly since one of the major goals of mathematics programs should be to facilitate the solution of problems.

Measurement

It is perhaps understandable that the grade six pupils would have difficulty with the interrelationships item in Figure 178. They have lacked success with virtually every aspect of the Metric System up to grade six so to expect them to put it all together seems absurd.

The lack of student success on the scale items is likely due to a combination of factors. It is difficult to test scale for example without bringing in many other factors such as understanding the units and measuring.

The results from the volume items in Figure 175 do not support the notion that volume is taught primarily with the formula. Grade four pupils did better on their volume test which was designed so that they could count blocks.

Geometry

The achievement gains made in 1979 over 1978 appear to indicate an increase in the time alloted to the geometry strand.

Question 19 in Figure 182 seems it test more than what the objective calls for.

Graphing

The data associated with the two grade six graphing objectives given in Figure 183 and 184 again suggests that pupils can better identify than write ordered pairs.

CHAPTER X

ANALYSIS OF THE DEMOGRAPHIC VARIABLES AND THE QUESTIONNAIRE; THE ACHIEVEMENT PROFILES

A. INTRODUCTION

The analyses of the demographic variables, which are in essence hypothesis three through six, are based on a series of F-tests. These tests check for differences between the achievement of students who belong to various subgroups. The subgroup classifications are male versus female, North Zone verses South Zone and Public School verses Separate School.

Each subgroup mean score was formed from the composite achievement of all students in the subgroup on all objectives within the five strands. The statistical data relating to each subgroup performance on the individual objectives for both 1978 and 1979 are included in the analysis sections of Chapters IV through IX. The comparisons there however are between the same subgroup in the two testing years.

Figures 185 to 190 in this chapter are used for clarification purposes and also to reduce the volume of reporting. With four sets of variables, five mathematics strands and six grades the latter aspect is of some importance. The format of these figures is such that any significant differences between subgroups can be viewed within the cell structure of the charts, grades one to six.

As for the previous analyses, a subgroup difference must have a probability level of less than 0.02 in order to be considered significant.

It should be noted that the Northlands School Division participated in the testing program at the grade two, four and five levels only. As both North Zone and Public School participants their influence on the subgroup performance may be significant.

As noted in the literature section of this study, pupil achievement in the Northland schools is likely affected by many conditions. Actual time in which pupils have been in contact with the mathematics content due to attendance problems is one real possibility. Supervisory adjustments to the Alberta Program of Studies (1978) is another. Such factors as teacher mobility and the sociological-environmental conditions may also have an influence on achievement. Also, the majority of students entering grade one do not have English as a first language.

B. RESTATEMENT OF THE HYPOTHESIS

Hypothesis Three

There will be no significant differences in mathematics achievement between the early and late starters in 1978 and 1979 on each of the Number, Operations and Properties, Measurement, Geometry, and Graphing strands in grades one through six.

Hypothesis Four

There will be no significant differences in mathematics achievement between boys and girls in 1978 and 1979 on each of the Number, Operations and Properties, Measurement, Geometry, and Graphing strands in grades one through six.

Hypothesis Five

There will be no significant difference in mathematics achievement between North and South Zone students in 1978 and 1979 on each of the five strands in grades one through six.

Hypothesis Six

There will be no significant difference in mathematics achievement between Public and Separate school students in 1978 and 1979 on each of the five strands in grades one through six.

C. DISCUSSION FROM THE RESULTS

Grade One

The data in Tables 23 and 24 indicate that the performance of the subgroups was fairly stable over the two years. Achievement means for all subgroups are relatively high. The female subgroup was the only one to dominate over its rival with any consistency. One-half of all cells reporting significant differences (Figure 185) belong to the girls.

Grade Two

With the exception of the 1978 achievement figures in

TABLE 23

COMPARISON OF SUBGROUP MEAN SCORES IN ZONE ONE FOR GRADE ONE NUMBER, OPERATIONS AND PROPERTIES, AND MEASUREMENT

COMPARING THE MEAN SCORES OF PUPILS WITHIN ZONE ONE SUBGROUPS

GRADE: 1 STRAND: NUMBER

YEAR	SUBGROUP		F-TEST TABLE SS BETWEEN	SS WITHIN	DF BETWEEN	DF WITHIN	F-RATIO	PROB
	EARLY	LATE						
1978	86.89	88.08	308.34	383791.63	1	2040	1.639	0.201
1979	89.44	87.84	1005.23	354299.47	1	1738	4.931	0.027
	MALE	FEMALE						
1978	88.29	88.92	212.25	409750.85	1	2124	1.100	0.295
1979	88.10	89.71	1197.53	374996.97	1	1844	5.889	0.015
	NORTH	SOUTH						
1978	89.59	88.20	826.38	409136.72	1	2124	4.290	0.038
1979	89.95	88.48	770.87	375423.63	1	1844	3.786	0.052
	PUBLIC	SEPARATE						
1978	88.56	88.72	9.03	409954.07	1	2124	0.047	0.829
1979	89.07	88.10	287.73	375906.76	1	1844	1.411	0.235

COMPARING THE MEAN SCORES OF PUPILS WITHIN ZONE ONE SUBGROUPS

GRADE: 1 STRAND: OPERATIONS & PROPERTIES

YEAR	SUBGROUP		F-TEST TABLE SS BETWEEN	SS WITHIN	DF BETWEEN	DF WITHIN	F-RATIO	PROB
	EARLY	LATE						
1978	84.69	83.89	297.11	749472.65	1	2040	0.809	0.369
1979	86.02	84.17	1337.75	563729.32	1	1736	4.124	0.043
	MALE	FEMALE						
1978	82.96	85.98	4815.07	783897.01	1	2124	13.047	0.000
1979	83.46	87.32	6859.52	599296.41	1	1844	21.106	0.000
	NORTH	SOUTH						
1978	85.22	84.10	545.21	788166.86	1	2124	1.469	0.226
1979	85.35	85.27	2.67	606153.26	1	1844	0.008	0.928
	PUBLIC	SEPARATE						
1978	83.98	86.20	1630.73	787081.35	1	2124	4.401	0.036
1979	85.15	85.81	134.79	606021.13	1	1844	0.410	0.522

COMPARING THE MEAN SCORES OF PUPILS WITHIN ZONE ONE SUBGROUPS

GRADE: 1 STRAND: MEASUREMENT

YEAR	SUBGROUP		F-TEST TABLE SS BETWEEN	SS WITHIN	DF BETWEEN	DF WITHIN	F-RATIO	PROB
	EARLY	LATE						
1978	85.02	83.22	1495.55	486955.06	1	2040	6.265	0.012
1979	84.50	83.26	933.85	542025.09	1	1738	2.994	0.084
	MALE	FEMALE						
1978	83.92	84.73	389.96	515680.48	1	2124	1.606	0.205
1979	83.47	84.67	663.36	578854.05	1	1844	2.113	0.146
	NORTH	SOUTH						
1978	85.18	84.01	586.19	515484.25	1	2124	2.415	0.120
1979	86.20	83.27	3044.49	576472.92	1	1844	9.739	0.002
	PUBLIC	SEPARATE						
1978	84.59	83.28	564.20	515506.25	1	2124	2.325	0.128
1979	84.73	81.50	3233.22	576284.19	1	1844	10.346	0.001

TABLE 24

COMPARISON OF SUBGROUP MEAN SCORES IN ZONE ONE FOR GRADE ONE GEOMETRY AND GRAPHING

```
    ___COMPAPING THE MEAN SCORES OF PUPILS WITHIN ZONE ONE SUBGROUPS____
                 GRADE: 1           STRAND:  GEOMETRY
                                    __________________F-TEST TABLE___________________
                                  #  _________SS________  ______DF______
YEAR        SUBGROUP              #__BETWEEN_____WITHIN_ BETWEEN WITHIN  F-RATIO  PROB
====== ================           #
           _EARLY___LATE__        #
1978        90.87     89.69       #    641.87  503620.80     1     2040     2.600   0.107
1979        90.16     90.23       #      1.78  546187.52     1     1738     0.006   0.940
           _MALE____FEMALE_       #
1978        90.27     90.74       #    115.84  522955.66     1     2124     0.470   0.493
1979        89.60     90.70       #    564.43  571290.00     1     1844     1.822   0.177
           _NORTH____SOUTH_       #
1978        89.94     90.72       #    260.60  522810.89     1     2124     1.059   0.304
1979        91.06     89.79       #    574.48  571279.95     1     1844     1.854   0.174
           PUBLIC SEPARATE        #
1978        90.76     89.41       #    604.02  522467.47     1     2124     2.456   0.117
1979        90.63     88.23       #   1790.89  570063.54     1     1844     5.793   0.016


    ___COMPARING THE MEAN SCORES OF PUPILS WITHIN ZONE ONE SUBGROUPS____
                 GRADE: 1           STRAND:  GRAPHING
                                    __________________F-TEST TABLE___________________
                                  #  _________SS________  ______DF______
YEAR        SUBGROUP              #__BETWEEN_____WITHIN_ BETWEEN WITHIN  F-RATIO  PROB
====== ================           #
           _EARLY___LATE__        #
1978        79.19     77.57       #   1218.78 1737341.85     1     2040     1.431   0.232
1979        80.31     77.21       #   3773.18 1486855.55     1     1738     4.411   0.036
           _MALE____FEMALE_       #
1978        76.78     80.55       #   7553.26 1907413.44     1     2124     8.876   0.003
1979        77.94     81.21       #   4922.15 1562199.19     1     1844     5.810   0.016
           _NORTH____SOUTH_       #
1978        79.36     78.29       #    492.99 1814473.71     1     2124     0.577   0.448
1979        81.58     78.75       #   2839.39 1564281.95     1     1844     3.347   0.068
           PUBLIC SEPARATE        #
1978        78.30     79.81       #    756.79 1814209.90     1     2124     0.886   0.347
1979        78.51     83.10       #   6512.23 1560609.11     1     1844     7.695   0.006
```

THE HYPOTHESIS	THE STRANDS									
	NUMBER		OPER. & PROP.		MEASUREMENT		GEOMETRY		GRAPHING	
	1978	1979	1978	1979	1978	1979	1978	1979	1978	1979
3 EARLY					▨					
LATE										
4 MALE										
FEMALE		▨	▨	▨					▨	▨
5 NORTH						▨				
SOUTH										
6 PUBLIC						▨		▨		
SEPARATE										▨

LEGEND

☐ Null Hypothesis Holds

▨ Null Hypothesis False

LATE ▨ ← Subgroup with Statistical Advantage

1978 ▨ Year of the Statistical Advantage

FIGURE 185

A CHART INDICATING WHICH SUBGROUPS IN
GRADE 1 HAVE STATISTICALLY HIGHER ACHIEVEMENT

TABLE 25

COMPARISON OF SUBGROUP MEAN SCORES IN ZONE ONE FOR GRADE TWO NUMBER, OPERATIONS AND PROPERTIES, AND MEASUREMENT

COMPARING THE MEAN SCORES OF PUPILS WITHIN ZONE ONE SUBGROUPS
GRADE: 2 STRAND: NUMBER

YEAR	SUBGROUP		F-TEST TABLE					
			SS		DF			
			BETWEEN	WITHIN	BETWEEN	WITHIN	F-RATIO	PROB
	EARLY	LATE						
1978	84.74	86.74	1954.75	461281.88	1	2233	9.463	0.002
1979	85.33	85.98	187.96	430487.40	1	1954	0.853	0.356
	MALE	FEMALE						
1978	84.80	86.05	897.12	473680.49	1	2301	4.358	0.037
1979	85.29	85.79	127.78	448867.14	1	2068	0.589	0.443
	NORTH	SOUTH						
1978	82.30	87.20	12807.90	461769.71	1	2301	63.822	0.000
1979	82.89	86.82	7028.42	441966.49	1	2068	32.887	0.000
	PUBLIC	SEPARATE						
1978	85.32	85.87	99.08	474478.53	1	2301	0.480	0.488
1979	85.09	87.56	1858.48	447136.43	1	2068	8.595	0.003

COMPARING THE MEAN SCORES OF PUPILS WITHIN ZONE ONE SUBGROUPS
GRADE: 2 STRAND: OPERATIONS & PROPERTIES

YEAR	SUBGROUP		F-TEST TABLE					
			SS		DF			
			BETWEEN	WITHIN	BETWEEN	WITHIN	F-RATIO	PROB
	EARLY	LATE						
1978	65.48	66.58	584.50	1185174.93	1	2233	1.101	0.294
1979	68.31	67.94	59.60	913346.03	1	1954	0.128	0.721
	MALE	FEMALE						
1978	64.58	67.58	5173.07	1208988.45	1	2301	9.846	0.002
1979	66.81	69.55	3885.35	967306.03	1	2068	8.306	0.004
	NORTH	SOUTH						
1978	64.86	66.72	1843.76	1212317.76	1	2301	3.499	0.062
1979	65.61	69.39	6529.88	964661.51	1	2068	13.998	0.000
	PUBLIC	SEPARATE						
1978	66.36	64.44	1199.87	1212961.65	1	2301	2.276	0.132
1979	67.58	70.77	3110.46	968080.93	1	2068	6.645	0.010

COMPARING THE MEAN SCORES OF PUPILS WITHIN ZONE ONE SUBGROUPS
GRADE: 2 STRAND: MEASUREMENT

YEAR	SUBGROUP		F-TEST TABLE					
			SS		DF			
			BETWEEN	WITHIN	BETWEEN	WITHIN	F-RATIO	PROB
	EARLY	LATE						
1978	69.34	71.08	1472.98	942337.39	1	2233	3.490	0.062
1979	73.42	73.26	10.51	675446.82	1	1954	0.030	0.862
	MALE	FEMALE						
1978	68.58	71.41	4606.01	969167.71	1	2301	10.936	0.001
1979	73.07	73.94	390.99	723921.46	1	2068	1.117	0.291
	NORTH	SOUTH						
1978	65.75	72.38	23500.21	950273.51	1	2301	56.904	0.000
1979	70.50	74.95	9028.57	715283.88	1	2068	26.103	0.000
	PUBLIC	SEPARATE						
1978	69.75	70.98	490.86	973282.86	1	2301	1.160	0.282
1979	72.41	78.46	11183.13	713129.33	1	2068	32.430	0.000

TABLE 26

COMPARISON OF SUBGROUP MEAN SCORES IN ZONE ONE FOR GRADE TWO GEOMETRY AND GRAPHING

```
   ____COMPARING_THE_MEAN_SCORES_OF_PUPILS_WITHIN_ZONE_ONE_SUBGROUPS____.
               GRADE: 2          STRAND:  GEOMETRY
                                  ___________________F-TEST TABLE__________________
                                  ___________________________DF______
YEAR      SUBGROUP          #  _________SS_________  ______DF______
======  ================   #__BETWEEN_____WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
         _EARLY___LATE__    #
1978     74.67     74.44    #     25.51 1223901.38     1      2233     0.047   0.829
1979     77.11     77.43    #     45.23  921623.28     1      1954     0.096   0.757
         _MALE___FEMALE_    #
1978     73.84     75.91    #   2476.29 1247748.46     1      2301     4.567   0.033
1979     76.39     78.42    #   2120.73  979269.71     1      2068     4.479   0.034
         _NORTH___SOUTH_    #
1978     73.27     75.76    #   3333.01 1246891.73     1      2301     6.151   0.013
1979     77.56     77.30    #     31.99  981258.45     1      2068     0.067   0.795
         PUBLIC_SEPARATE    #
1978     74.51     76.51    #   1285.11 1248939.64     1      2301     2.368   0.124
1979     76.80     80.08    #   3293.24  978097.20     1      2068     6.963   0.008


   ____COMPARING_THE_MEAN_SCORES_OF_PUPILS_WITHIN_ZONE_ONE_SUBGROUPS_____
               GRADE: 2          STRAND:  GRAPHING
                                  ___________________F-TEST TABLE__________________
YEAR      SUBGROUP          #  _________SS_________  ______DF______
=====   ================   #__BETWEEN_____WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
         _EARLY___LATE__    #
1978     75.68     78.09    #   2838.71 2149556.38     1      2233     2.949   0.086
1979     79.73     80.47    #    242.87 1621804.61     1      1954     0.293   0.589
         _MALE___FEMALE_    #
1978     75.78     77.90    #   2570.99 2200832.54     1      2301     2.688   0.101
1979     79.55     80.33    #    313.19 1711101.03     1      2068     0.379   0.538
         _NORTH___SOUTH_    #
1978     71.39     79.94    #  39110.31 2164293.21     1      2301    41.581   0.000
1979     73.07     83.28    #  47480.54 1663933.68     1      2068    59.011   0.000
         PUBLIC_SEPARATE    #
1978     75.64     82.61    #  15661.43 2187742.09     1      2301    16.472   0.000
1979     78.47     86.63    #  20321.04 1691083.18     1      2068    24.863   0.000
```

THE HYPOTHESIS	THE STRANDS									
	NUMBER		OPER. & PROP.		MEASUREMENT		GEOMETRY		GRAPHING	
	1978	1979	1978	1979	1978	1979	1978	1979	1978	1979
3										
EARLY										
LATE	▨									
4										
MALE										
FEMALE			▨	▨	▨					
5										
NORTH										
SOUTH	▨	▨		▨	▨	▨	▨		▨	▨
6										
PUBLIC										
SEPARATE		▨		▨		▨		▨	▨	▨

LEGEND

☐ Null Hypothesis Holds

▨ Null Hypothesis False

LATE ▨ Subgroup with Statistical Advantage

1978 ▨ Year of the Statistical Advantage

FIGURE 186

A CHART INDICATING WHICH SUBGROUPS IN
GRADE 2 HAVE STATISTICALLY HIGHER ACHIEVEMENT

Number, where the late starters do better, the performances of the early and late starters run quite parallel.

The statistics in Tables 25 and 26 indicate a stronger performance for girls in the Operations and Properties objectives. The Chapter V analysis of the individual objectives underscores the female strength in that they record higher achievement scores on each of the objectives. Figure 186 indicates that the girls lost their grade one achievement advantage in the Number and Graphing strands but were significantly superior in Measurement for 1978 only.

The South Zone students do significantly better for eight of ten possible comparisons. As noted earlier the Northland School Division participated in the grade two testing for both 1978 and 1979 and this may have influenced both the North-South and the Public-Separate statistics. (Note the possible reasons on page 322).

Clearly the Separate school students in grade two show the greatest gains for 1979.

Grade Three

No differences exist between the early and late starter subgroups at the grade three level.

There are however significant differences between boys and girls for both 1978 and 1979 on the Operations and Properties strand and on the 1978 Measurement strand.

From the grade three analysis of the individual objectives it is clear that girls show the greatest advantages over boys in their understanding of the basic

TABLE 27

COMPARISON OF SUBGROUP MEAN SCORES IN ZONE ONE FOR GRADE THREE NUMBER, OPERATIONS AND PROPERTIES, AND MEASUREMENT

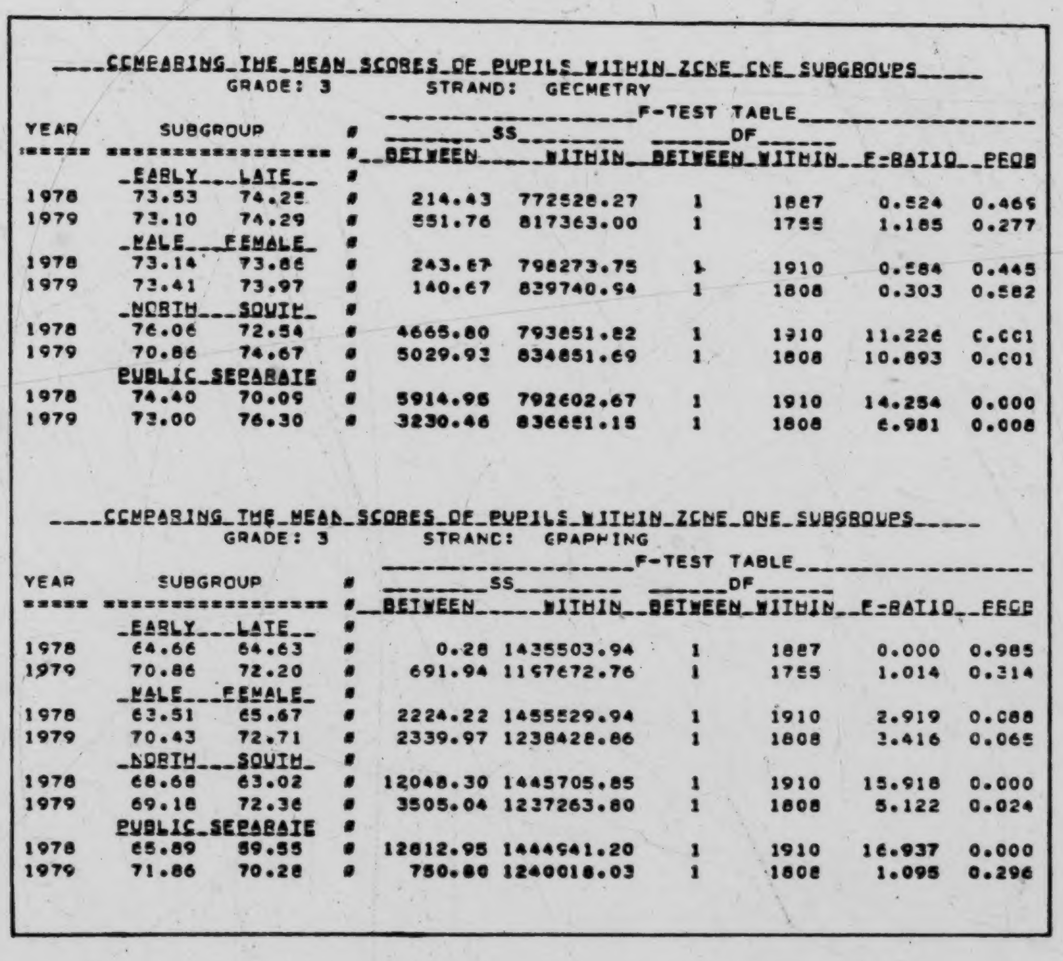
```
 ____COMPARING_THE_MEAN_SCORES_OF_PUPILS_WITHIN_ZONE_ONE_SUBGROUPS_____
               GRADE: 3        STRAND:  NUMBER
                               ____________________F-TEST TABLE__________________
YEAR        SUBGROUP         #  ________SS________  ______DF______
:===== ================== #__BETWEEN_____WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
        _EARLY___LATE__     #
1978     70.27    70.21     #       1.47  906793.88    1        1887      0.003   0.956
1979     71.61    71.66     #       1.02  784694.63    1        1755      0.002   0.962
        _MALE___FEMALE_     #
1978     69.77    70.55     #     286.71  919047.85    1        1910      0.596   0.440
1979     72.27    71.49     #     273.68  804369.87    1        1808      0.615   0.433
        _NORTH___SOUTH_     #
1978     72.78    69.17     #    4894.04  914440.51    1        1910     10.222   0.001
1979     67.55    73.40     #   11857.05  792786.50    1        1808     27.041   0.000
        PUBLIC_SEPARATE     #
1978     70.31    69.52     #     202.81  919131.74    1        1910      0.421   0.516
1979     72.67    68.91     #    4206.33  800437.22    1        1808      9.501   0.002


 ____COMPARING_THE_MEAN_SCORES_OF_PUPILS_WITHIN_ZONE_ONE_SUBGROUPS_____
               GRADE: 3        STRAND:  OPERATIONS & PROPERTIES
                               ____________________F-TEST TABLE__________________
YEAR        SUBGROUP         #  ________SS________  ______DF______
===== ================== #__BETWEEN_____WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
        _EARLY___LATE__     #
1978     72.33    74.20     #    1454.30  637888.39    1        1887      4.302   0.038
1979     72.42    71.88     #     111.05  573377.42    1        1755      0.340   0.560
        _MALE___FEMALE_     #
1978     71.39    74.46     #    4494.93  648099.50    1        1910     13.247   0.000
1979     71.41    73.59     #    2155.78  584312.13    1        1808      6.670   0.010
        _NORTH___SOUTH_     #
1978     73.74    72.54     #     537.96  652056.47    1        1910      1.576   0.210
1979     68.97    73.68     #    7692.39  578775.51    1        1808     24.030   0.000
        PUBLIC_SEPARATE     #
1978     73.54    70.36     #    3224.69  649369.74    1        1910      9.485   0.002
1979     72.68    71.76     #     233.59  586234.32    1        1808      0.720   0.396


 ____COMPARING_THE_MEAN_SCORES_OF_PUPILS_WITHIN_ZONE_ONE_SUBGROUPS_____
               GRADE: 3        STRAND:  MEASUREMENT
                               ____________________F-TEST TABLE__________________
YEAR        SUBGROUP         #  ________SS________  ______DF______
:===== ================== #__BETWEEN_____WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
        _EARLY___LATE__     #
1978     67.16    68.26     #     502.06  766445.89    1        1887      1.236   0.266
1979     68.07    69.79     #    1152.29  772966.32    1        1755      2.616   0.106
        _MALE___FEMALE_     #
1978     66.06    68.79     #    3557.01  777465.24    1        1910      6.739   0.003
1979     68.12    69.45     #     792.73  796951.55    1        1808      1.798   0.180
        _NORTH___SOUTH_     #
1978     67.86    67.20     #     166.09  780856.16    1        1910      0.406   0.524
1979     65.25    69.99     #    7782.99  789961.29    1        1808     17.813   0.000
        PUBLIC_SEPARATE     #
1978     67.75    65.99     #     987.97  780034.28    1        1910      2.419   0.120
1979     68.37    70.29     #    1095.33  796648.95    1        1808      2.486   0.115
```

TABLE 28

COMPARISON OF SUBGROUP MEAN SCORES IN ZONE ONE FOR GRADE THREE GEOMETRY AND GRAPHING



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____COMPARING_THE_MEAN_SCORES_OF_PUPILS_WITHIN_ZONE_ONE_SUBGROUPS_____
              GRADE: 3        STRAND:  GEOMETRY
                                __________________F-TEST TABLE_________________
YEAR      SUBGROUP        #  ________SS________  _______DF______
====== ================== #__BETWEEN_____WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
        _EARLY___LATE__   #
1978     73.53    74.25   #    214.43  772528.27     1      1887     0.524  0.469
1979     73.10    74.29   #    551.76  817363.00     1      1755     1.185  0.277
        _MALE___FEMALE_   #
1978     73.14    73.86   #    243.67  798273.75     1      1910     0.584  0.445
1979     73.41    73.97   #    140.67  829740.94     1      1808     0.303  0.582
        _NORTH___SOUTH_   #
1978     76.06    72.54   #   4665.80  793851.82     1      1910    11.226  0.001
1979     70.86    74.67   #   5029.93  834851.69     1      1808    10.893  0.001
        PUBLIC_SEPARATE   #
1978     74.40    70.09   #   5914.95  792602.67     1      1910    14.254  0.000
1979     73.00    76.30   #   3230.46  836651.15     1      1808     6.981  0.008


____COMPARING_THE_MEAN_SCORES_OF_PUPILS_WITHIN_ZONE_ONE_SUBGROUPS_____
              GRADE: 3        STRAND:  GRAPHING
                                __________________F-TEST TABLE_________________
YEAR      SUBGROUP        #  ________SS________  _______DF______
===== ==================  #__BETWEEN_____WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
        _EARLY___LATE__   #
1978     64.66    64.63   #      0.28 1435503.94     1      1887     0.000  0.985
1979     70.86    72.20   #    691.94 1197672.76     1      1755     1.014  0.314
        _MALE___FEMALE_   #
1978     63.51    65.67   #   2224.22 1455529.94     1      1910     2.919  0.088
1979     70.43    72.71   #   2339.97 1238428.86     1      1808     3.416  0.065
        _NORTH___SOUTH_   #
1978     68.68    63.02   #  12048.30 1445705.85     1      1910    15.918  0.000
1979     69.18    72.36   #   3505.04 1237263.80     1      1808     5.122  0.024
        PUBLIC_SEPARATE   #
1978     65.89    59.55   #  12812.95 1444941.20     1      1910    16.937  0.000
1979     71.86    70.28   #    750.80 1240018.03     1      1808     1.095  0.296
```

THE HYPOTHESIS	THE STRANDS									
	NUMBER		OPER. & PROP.		MEASUREMENT		GEOMETRY		GRAPHING	
	1978	1979	1978	1979	1978	1979	1978	1979	1978	1979
3 EARLY										
LATE										
4 MALE										
FEMALE			▨	▨	▨					
5 NORTH	▨						▨		▨	
SOUTH		▨		▨		▨		▨		
6 PUBLIC		▨	▨				▨		▨	
SEPARATE								▨		

LEGEND

☐ Null Hypothesis Holds

▨ Null Hypothesis False

LATE ▨ Subgroup with Statistical Advantage

1978 ▨ Year of the Statistical Advantage

FIGURE 187

A CHART INDICATING WHICH SUBGROUPS IN
GRADE 3 HAVE STATISTICALLY HIGHER ACHIEVEMENT

facts and in their performance with the addition and subtraction algorithms. It appears as though the girls have committed more of the basic facts to memory than the boys have.

It is interesting to note that the North Zone students do better than the South in three strands for 1978 but none in 1979. The South zone pupils significantly outperform the North on four of the five strands in 1979.

The Public school students outperformed the Separate students in four strands (3 in 1978). The Separate pupils were superior in only one, that of Geometry for 1979.

Grade Four

It is interesting to note from Tables 29 and 30 that being older than 6.0 years at school entry offers a significant and consistant advantage beginning at the grade four level.

Again the female students record significantly higher achievement scores than boys on the Operations and Properties strand. Indeed this is the case for all ten of the objectives that make up the strand (Chapter VII). Girls also outperform the boys in Number for 1978 and Geometry for 1979.

Performance comparisons for the grade four North and South Zone pupils are similar to those from the grade two level except here all comparisons are significant.

The data from Tables 29 and 30 and from grades two, three and four indicates that Separate school pupils made

FIGURE 29

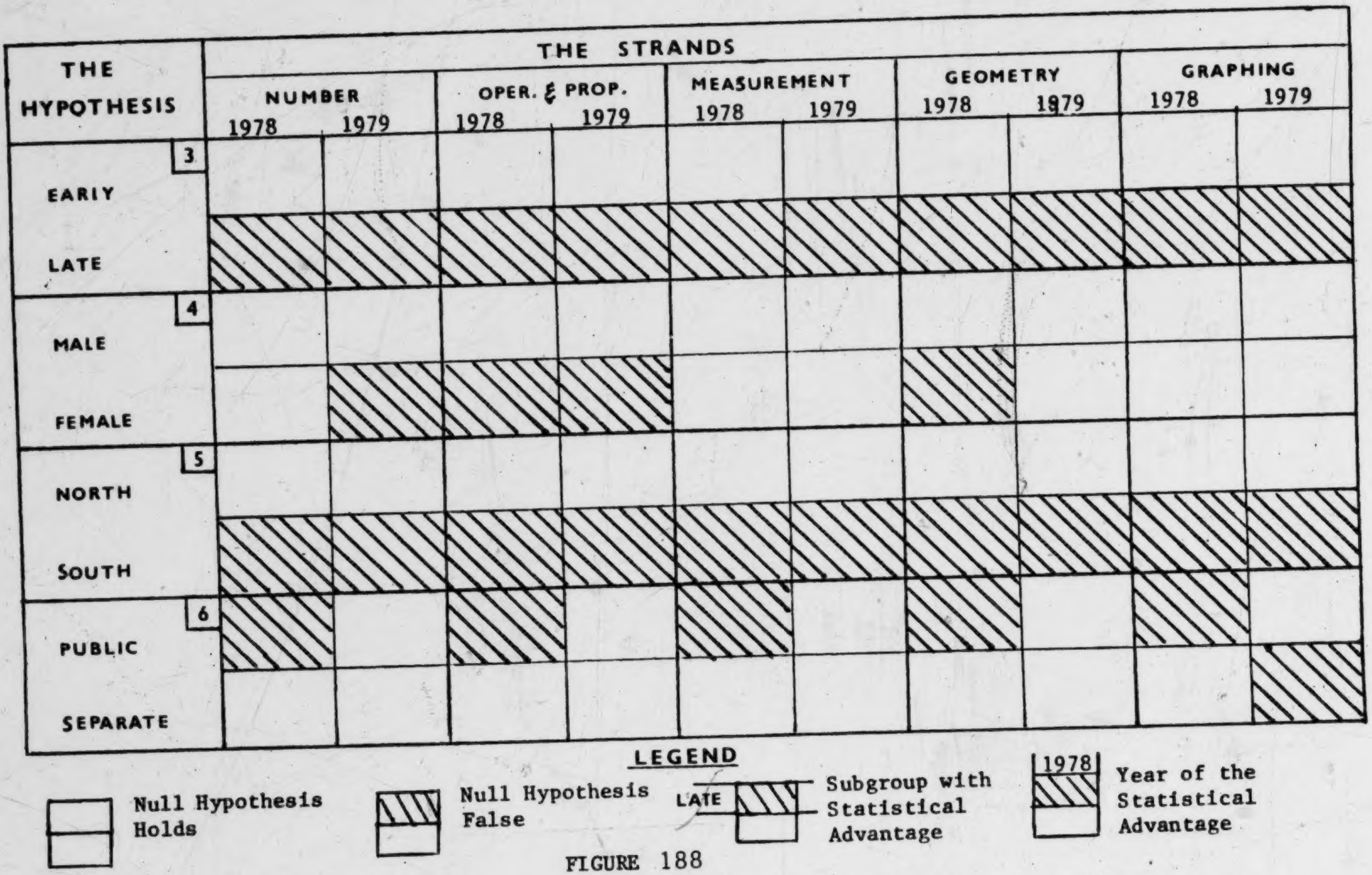
COMPARISON OF THE SUBGROUP MEAN SCORES IN ZONE ONE FOR GRADE FOUR NUMBER, OPERATIONS AND PROPERTIES, AND MEASUREMENT

```
                                         ___COMPARING_THE_MEAN_SCORES_OF_PUPILS_WITHIN_ZONE_ONE_SUBGROUPS_____
                 GRADE: 4        STRAND:  NUMBER
                                ____________________F-TEST TABLE___________________
YEAR        SUBGROUP        #  _________SS_________  ______DF______
=====  ================== #__BETWEEN_____WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
          _EARLY___LATE__   #
1978       43.88    49.08   #  12036.29 1277382.01     1      2073    19.533   0.000
1979       50.20    57.37   #  22087.42 1256978.52     1      1925    33.826   0.000
          _MALE___FEMALE_   #
1978       45.21    45.98   #    313.63 1305793.35     1      2113     0.508   0.476
1979       50.90    54.28   #   5593.59 1292831.43     1      1967     6.510   0.004
          _NORTH___SOUTH_   #
1978       40.52    48.52   #  31429.91 1274677.07     1      2113    52.101   0.000
1979       42.95    57.43   #  92928.51 1205496.51     1      1967   151.631   0.000
          PUBLIC_SEPARATE   #
1978       46.68    40.77   #  11133.46 1294973.53     1      2113    18.166   0.000
1979       52.22    53.54   #    543.67 1297881.35     1      1967     0.824   0.364


                                         ___COMPARING_THE_MEAN_SCORES_OF_PUPILS_WITHIN_ZONE_ONE_SUBGROUPS_____
                 GRADE: 4        STRAND:  OPERATIONS & PROPERTIES
                                ____________________F-TEST TABLE___________________
YEAR        SUBGROUP        #  _________SS_________  ______DF______
=====  ================== #__BETWEEN_____WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
          _EARLY___LATE__   #
1978       52.64    57.34   #   9812.79 1123162.05     1      2073    18.111   0.000
1979       54.33    60.20   #  14834.05 1005408.75     1      1925    28.402   0.000
          _MALE___FEMALE_   #
1978       52.48    56.00   #   6555.31 1151255.73     1      2113    12.032   0.001
1979       53.77    59.05   #  13668.64 1022024.45     1      1967    26.307   0.000
          _NORTH___SOUTH_   #
1978       48.98    57.19   #  33095.60 1124715.43     1      2113    62.177   0.000
1979       48.85    60.07   #  55826.88  979866.21     1      1967   112.068   0.000
          PUBLIC_SEPARATE   #
1978       55.43    48.67   #  14565.74 1143245.29     1      2113    26.921   0.000
1979       56.53    55.04   #    692.80 1035000.29     1      1967     1.317   0.251


                                         ___COMPARING_THE_MEAN_SCORES_OF_PUPILS_WITHIN_ZONE_ONE_SUBGROUPS_____
                 GRADE: 4        STRAND:  MEASUREMENT
                                ____________________F-TEST TABLE___________________
YEAR        SUBGROUP        #  _________SS_________  ______DF______
=====  ================== #__BETWEEN_____WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
          _EARLY___LATE__   #
1978       43.93    48.02   #   7434.58  949395.50     1      2073    16.233   0.000
1979       48.50    53.34   #  10031.49  936030.21     1      1925    20.630   0.000
          _MALE___FEMALE_   #
1978       46.31    44.31   #   2092.70  974841.27     1      2113     4.536   0.033
1979       50.38    49.93   #     99.24  957576.95     1      1967     0.204   0.652
          _NORTH___SOUTH_   #
1978       41.46    47.59   #  18492.92  958441.05     1      2113    40.770   0.000
1979       44.32    53.21   #  35036.68  922639.51     1      1967    74.696   0.000
          PUBLIC_SEPARATE   #
1978       46.39    40.72   #  10244.80  966689.47     1      2113    22.393   0.000
1979       50.52    48.73   #    993.05  956683.14     1      1967     2.042   0.153
```

TABLE 30

COMPARISON OF THE SUBGROUP MEAN SCORES IN ZONE ONE FOR GRADE FOUR GEOMETRY AND GRAPHING

```
    ____COMPARING_THE_MEAN_SCORES_OF_PUPILS_WITHIN_ZONE_ONE_SUBGROUPS_____
                    GRADE: 4          STRAND:  GEOMETRY
                                   __________________F-TEST TABLE__________________
YEAR         SUBGROUP        #  ________SS________  ______DF______
====== ================= #__BETWEEN_____WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
          _EARLY___LATE__    #
1978       56.24     59.62   #    5084.51 1841742.60     1      2073     5.723  0.017
1979       61.26     67.17   #   15004.66 1747888.46     1      1925    16.525  0.000
          _MALE___FEMALE_    #
1978       55.93     59.01   #    5006.77 1872530.50     1      2113     5.650  0.018
1979       62.51     64.67   #    2282.28 1795065.32     1      1967     2.501  0.114
          _NORTH___SOUTH_    #
1978       53.98     59.41   #   14468.94 1863068.32     1      2113    16.410  0.000
1979       55.10     67.90   #   72512.24 1724835.36     1      1967    82.693  0.000
          PUBLIC_SEPARATE    #
1978       56.18     54.05   #    5431.43 1872105.84     1      2113     6.130  0.013
1979       63.67     62.91   #     181.80 1797165.80     1      1967     0.199  0.656


    ____COMPARING_THE_MEAN_SCORES_OF_PUPILS_WITHIN_ZONE_ONE_SUBGROUPS_____
                    GRADE: 4          STRAND:  GRAPHING
                                   __________________F-TEST TABLE__________________
YEAR         SUBGROUP        #  ________SS________  ______DF______
====== ================= #__BETWEEN_____WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
          _EARLY___LATE__    #
1978       62.47     67.69   #   12069.64 1503350.56     1      2073    16.643  0.000
1979       66.99     73.79   #   19851.59 1342961.23     1      1925    28.455  0.000
          _MALE___FEMALE_    #
1978       63.00     65.34   #    2894.72 1540034.10     1      2113     3.972  0.046
1979       68.43     70.62   #    2357.87 1379400.15     1      1967     3.362  0.067
          _NORTH___SOUTH_    #
1978       59.26     66.94   #   28976.67 1513952.14     1      2113    40.442  0.000
1979       62.77     72.93   #   45677.56 1336080.46     1      1967    67.247  0.000
          PUBLIC_SEPARATE    #
1978       65.56     57.00   #   19214.84 1523713.98     1      2113    26.646  0.000
1979       68.16     74.79   #   13642.15 1366115.87     1      1967    15.614  0.000
```



THE HYPOTHESIS	THE STRANDS									
	NUMBER		OPER. & PROP.		MEASUREMENT		GEOMETRY		GRAPHING	
	1978	1979	1978	1979	1978	1979	1978	1979	1978	1979
3 EARLY										
LATE	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨
4 MALE										
FEMALE		▨	▨	▨			▨			
5 NORTH										
SOUTH	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨
6 PUBLIC	▨		▨		▨		▨		▨	
SEPARATE										▨

LEGEND

☐ Null Hypothesis Holds

▨ Null Hypothesis False

LATE ▨ Subgroup with Statistical Advantage

1978 ▨ Year of the Statistical Advantage

FIGURE 188

A CHART INDICATING WHICH SUBGROUPS IN GRADE 4 HAVE STATISTICALLY HIGHER ACHIEVEMENT

TABLE 31

COMPARISON OF THE SUBGROUP MEAN SCORES IN ZONE ONE FOR GRADE FIVE NUMBER, OPERATIONS AND PROPERTIES, AND MEASUREMENT

```
----COMPARING_THE_MEAN_SCORES_OF_PUPILS_WITHIN_ZONE_ONE_SUBGROUPS____
             GRADE: 5        STRAND:  NUMBER
                              ___________________F-TEST TABLE__________________
YEAR      SUBGROUP       #    ________SS________   ______DF______
===== ================== #__BETWEEN_____WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
        _EARLY___LATE__  #
1978     46.35    53.43  #  23016.92 1387306.21    1      2103    34.891  0.000
1979     51.38    54.89  #   4859.40 1100391.47    1      1763     7.786  0.005
        _MALE___FEMALE_  #
1978     47.09    49.86  #   4077.83 1423582.34    1      2127     6.093  0.014
1979     53.19    52.78  #     78.66 1198869.78    1      1860     0.122  0.727
        _NORTH___SOUTH_  #
1978     42.05    52.11  #  49908.49 1377751.68    1      2127    77.050  0.000
1979     48.48    55.51  #  21168.58 1177779.86    1      1860    33.430  0.000
        PUBLIC_SEPARATE  #
1978     48.20    49.65  #    643.13 1427017.04    1      2127     0.959  0.328
1979     52.00    57.59  #   8477.46 1190470.98    1      1860    13.245  0.000


----COMPARING_THE_MEAN_SCORES_OF_PUPILS_WITHIN_ZONE_ONE_SUBGROUPS____
             GRADE: 5        STRAND:  OPERATIONS & PROPERTIES
                              ___________________F-TEST TABLE__________________
YEAR      SUBGROUP       #    ________SS________   ______DF______
===== ================== #__BETWEEN_____WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
        _EARLY___LATE__  #
1978     56.32    62.31  #  16477.65  930779.43    1      2103    37.230  0.000
1979     58.74    61.86  #   3842.57  724357.08    1      1763     9.352  0.002
        _MALE___FEMALE_  #
1978     55.58    60.77  #  14311.47  945040.34    1      2127    32.211  0.000
1979     58.65    61.27  #   3198.65  777978.07    1      1860     7.647  0.006
        _NORTH___SOUTH_  #
1978     52.95    61.09  #  32663.24  926688.57    1      2127    74.971  0.000
1979     56.42    61.89  #  12828.73  768347.99    1      1860    31.056  0.000
        PUBLIC_SEPARATE  #
1978     58.06    58.47  #     50.38  959301.43    1      2127     0.112  0.738
1979     59.72    60.93  #    394.98  780781.74    1      1860     0.941  0.332


----COMPARING_THE_MEAN_SCORES_OF_PUPILS_WITHIN_ZONE_ONE_SUBGROUPS____
             GRADE: 5        STRAND:  MEASUREMENT
                              ___________________F-TEST TABLE__________________
YEAR      SUBGROUP       #    ________SS________   ______DF______
===== ================== #__BETWEEN_____WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
        _EARLY___LATE__  #
1978     53.63    59.79  #  17429.83 1051787.76    1      2103    34.850  0.000
1979     58.89    63.37  #   7926.56  785726.98    1      1763    17.785  0.000
        _MALE___FEMALE_  #
1978     54.66    56.33  #   1474.53 1082797.92    1      2127     2.896  0.089
1979     60.51    60.66  #     10.00  861885.42    1      1860     0.022  0.883
        _NORTH___SOUTH_  #
1978     50.17    58.51  #  34249.20 1050023.25    1      2127    69.378  0.000
1979     55.15    63.62  #  30664.48  831230.94    1      1860    68.616  0.000
        PUBLIC_SEPARATE  #
1978     55.40    55.88  #     69.78 1084202.67    1      2127     0.137  0.711
1979     60.07    62.96  #   2267.74  859627.68    1      1860     4.907  0.027
```

TABLE 32

COMPARISON OF THE SUBGROUP MEAN SCORES IN ZONE ONE FOR GRADE FIVE GEOMETRY AND GRAPHING

COMPARING THE MEAN SCORES OF PUPILS WITHIN ZONE ONE SUBGROUPS

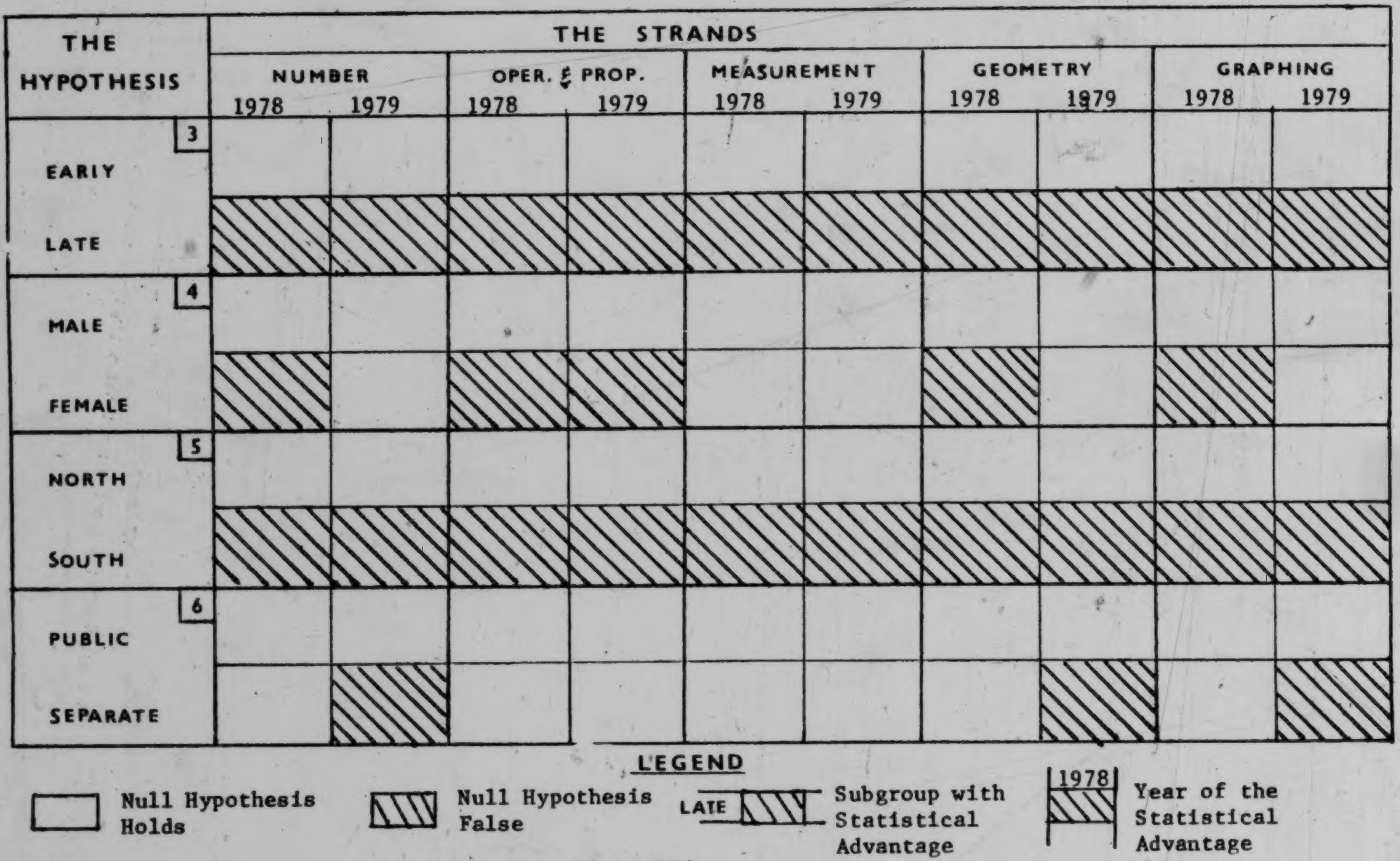
GRADE: 5 STRAND: GEOMETRY

YEAR	SUBGROUP		F-TEST TABLE SS BETWEEN	SS WITHIN	DF BETWEEN	DF WITHIN	F-RATIO	PROB
	EARLY	LATE						
1978	54.24	60.27	16694.17	1609460.28	1	2103	21.813	0.000
1979	60.91	64.61	5382.76	1188058.01	1	1763	7.988	0.005
	MALE	FEMALE						
1978	53.70	58.47	12107.05	1636387.70	1	2127	15.737	0.000
1979	61.79	63.07	767.85	1274756.87	1	1860	1.120	0.290
	NORTH	SOUTH						
1978	50.84	59.01	32895.14	1615599.61	1	2127	43.308	0.000
1979	55.23	66.43	53711.37	1221813.36	1	1860	81.766	0.000
	PUBLIC	SEPARATE						
1978	55.91	56.68	183.66	1648311.09	1	2127	0.237	0.626
1979	61.60	66.18	5690.90	1269833.82	1	1860	8.336	0.004

COMPARING THE MEAN SCORES OF PUPILS WITHIN ZONE ONE SUBGROUPS

GRADE: 5 STRAND: GRAPHING

YEAR	SUBGROUP		F-TEST TABLE SS BETWEEN	SS WITHIN	DF BETWEEN	DF WITHIN	F-RATIO	PROB
	EARLY	LATE						
1978	52.10	60.07	29154.96	1704245.15	1	2103	35.977	0.000
1979	60.68	66.65	14014.51	1218643.62	1	1763	20.275	0.000
	MALE	FEMALE						
1978	52.19	56.74	11018.91	1750159.03	1	2127	13.391	0.000
1979	61.61	64.36	3532.23	1311258.20	1	1860	5.010	0.025
	NORTH	SOUTH						
1978	47.59	58.34	56970.52	1704207.42	1	2127	71.104	0.000
1979	56.45	66.59	44072.16	1270718.28	1	1860	64.510	0.000
	PUBLIC	SEPARATE						
1978	54.18	55.61	621.44	1760556.50	1	2127	0.751	0.387
1979	62.04	67.24	7348.17	1307442.27	1	1860	10.454	0.001



THE HYPOTHESIS		THE STRANDS									
		NUMBER		OPER. & PROP.		MEASUREMENT		GEOMETRY		GRAPHING	
		1978	1979	1978	1979	1978	1979	1978	1979	1978	1979
3	EARLY	□	□	□	□	□	□	□	□	□	□
	LATE	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨
4	MALE	□	□	□	□	□	□	□	□	□	□
	FEMALE	▨	□	▨	▨	□	□	▨	□	▨	□
5	NORTH	□	□	□	□	□	□	□	□	□	□
	SOUTH	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨
6	PUBLIC	□	□	□	□	□	□	□	□	□	□
	SEPARATE	□	▨	□	□	□	□	□	▨	□	▨

LEGEND

□ Null Hypothesis Holds

▨ Null Hypothesis False

LATE ▨ Subgroup with Statistical Advantage

1978 ▨ Year of the Statistical Advantage

FIGURE 189

A CHART INDICATING WHICH SUBGROUPS IN
GRADE 5 HAVE STATISTICALLY HIGHER ACHIEVEMENT

the largest gains in 1979. However the only significantly higher performance for the Separate school pupils was in Graphing for 1979. Public school pupils had all of their significantly superior strands in 1978.

Grade Five

The trend of superior achievement for the late over the early starters that was started in grade four continues into level five. It was interesting to compare the grade four and grade five mean score differences between the 1978 and 1979 early and late starters (Chapter VIII). At grade five the 1978 late starters have the greatest advantage over their early starting counterparts. The advantage was reversed at the grade four level where the 1979 late starters had the larger percentage difference. This might suggest that the 1979 group of grade five early starters, who were the same group of 1978 early starters in grade four, may be superior to the early starters before this time. Early Childhood supporters might wish to note that this group of pupils was the first to be involved in the expansion of Early Childhood programs within the Zone.

Although the female students had some superior performances, over males most of these were in 1978; male students actually received higher but not significantly higher scores for 1979. The boys predominating weakness continues to be with their knowledge, skills and understanding within the Operations and Properties strand.

For each of grades two and four where the Northland

School Division were involved, the South Zone students received significantly higher mean scores. This pattern is continued for grade five.

The Separate school pupils had significantly higher 1979 test performances than did the Public school students in the Number, Geometry, and Graphing strands. This trend was noted for some of the previous grades.

Grade Six

The data provided in Tables 33 and 34 and in the Chart Figure 190 again gives a significant achievement advantage to the late starter subgroup. Higher mean scores are recorded within each of the strands for 1978 and 1979 although the difference in the graphing strand was not significant.

The domain of concepts, skills and understandings within the Operations and Properties strand, belongs completely to the girls at all grades. On the specific objectives within the strand (Chapter IX) boys fare below the girls by an average of five percentage points for all but the problem solving objective. Here boys have a slight but not a significant advantage.

The achievement difference between the North and South Zone diminishes to the point where only two differences in 1978 are significant at the grade six level.

The grades four and six achievement profiles for the Public and Separate school pupils are almost identical. The trend at both levels was for the Public school pupils to

TABLE 33

COMPARISON OF THE SUBGROUP MEAN SCORES IN ZONE ONE FOR THE GRADE SIX NUMBER, OPERATIONS AND PROPERTIES, AND MEASUREMENT

COMPARING THE MEAN SCORES OF PUPILS WITHIN ZONE ONE SUBGROUPS

GRADE: 6 STRAND: NUMBER

YEAR	SUBGROUP		F-TEST TABLE					
			SS		DF			
			BETWEEN	WITHIN	BETWEEN	WITHIN	F-RATIO	PROB
	EARLY	LATE						
1978	49.29	55.47	15231.12	1261375.37	1	1838	22.194	0.000
1979	58.48	65.36	17295.03	1022886.47	1	1572	26.579	0.000
	MALE	FEMALE						
1978	50.93	51.84	390.02	1315884.51	1	1895	0.562	0.454
1979	59.26	62.93	5594.19	1103513.74	1	1666	8.446	0.004
	NORTH	SOUTH						
1978	47.06	52.94	12838.72	1303435.81	1	1895	18.666	0.000
1979	60.06	61.43	623.71	1108484.22	1	1666	0.937	0.333
	PUBLIC	SEPARATE						
1978	52.24	47.81	5810.96	1310463.57	1	1895	8.403	0.004
1979	61.47	59.31	1211.32	1107896.61	1	1666	1.822	0.177

COMPARING THE MEAN SCORES OF PUPILS WITHIN ZONE ONE SUBGROUPS

GRADE: 6 STRAND: OPERATIONS & PROPERTIES

YEAR	SUBGROUP		F-TEST TABLE					
			SS		DF			
			BETWEEN	WITHIN	BETWEEN	WITHIN	F-RATIO	PROB
	EARLY	LATE						
1978	57.13	62.23	10359.26	926558.07	1	1838	20.550	0.000
1979	60.76	64.66	5538.47	762460.15	1	1572	11.419	0.001
	MALE	FEMALE						
1978	56.70	61.24	9750.05	955735.83	1	1895	19.332	0.000
1979	59.48	64.68	11280.73	806776.90	1	1666	23.295	0.000
	NORTH	SOUTH						
1978	58.20	59.17	345.78	965140.10	1	1895	0.679	0.410
1979	61.83	62.10	25.41	818032.22	1	1666	0.052	0.820
	PUBLIC	SEPARATE						
1978	59.54	56.30	3116.15	962369.73	1	1895	6.136	0.013
1979	61.53	64.12	1749.61	816308.03	1	1666	3.571	0.059

COMPARING THE MEAN SCORES OF PUPILS WITHIN ZONE ONE SUBGROUPS

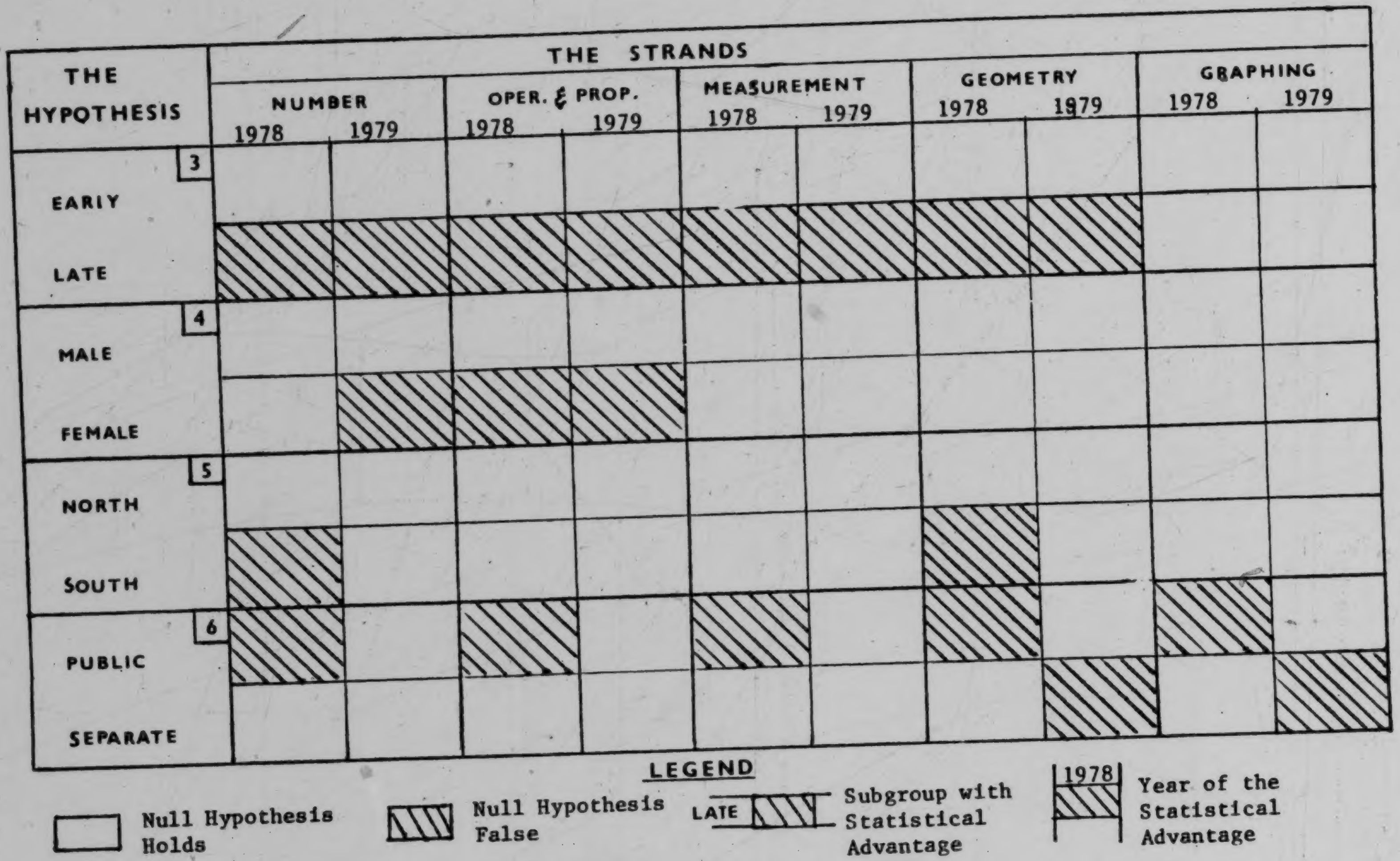
GRADE: 6 STRAND: MEASUREMENT

YEAR	SUBGROUP		F-TEST TABLE					
			SS		DF			
			BETWEEN	WITHIN	BETWEEN	WITHIN	F-RATIO	PROB
	EARLY	LATE						
1978	39.76	44.18	7803.59	1217083.24	1	1838	11.785	0.001
1979	44.71	50.04	10379.08	1054378.49	1	1572	15.474	0.000
	MALE	FEMALE						
1978	41.64	40.39	734.12	1251879.08	1	1895	1.111	0.292
1979	46.59	46.20	63.37	1128639.36	1	1666	0.094	0.760
	NORTH	SOUTH						
1978	40.46	41.24	227.30	1252385.90	1	1895	0.344	0.558
1979	44.23	47.23	3007.74	1125694.99	1	1666	4.451	0.035
	PUBLIC	SEPARATE						
1978	42.16	36.36	9986.16	1242627.05	1	1895	15.229	0.000
1979	46.04	47.95	949.32	1127753.41	1	1666	1.402	0.237

TABLE 34

COMPARISON OF THE SUBGROUP MEAN SCORES IN ZONE ONE FOR GRADE SIX GEOMETRY AND GRAPHING

```
 ____COMPARING_THE_MEAN_SCORES_OF_PUPILS_WITHIN_ZONE_ONE_SUBGROUPS_____
                  GRADE: 6         STRAND:  GEOMETRY
                                 ___________________F-TEST TABLE___________________
                                 # _________SS________  ______DF______
YEAR        SUBGROUP             #__BETWEEN_____WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
=====  ================= #
         _EARLY___LATE__ #
1978       51.29    55.04  #    5611.43 1376252.34      1       1838     7.494   0.006
1979       57.69    61.52  #    5338.08 1226275.82      1       1572     6.843   0.009
         _MALE___FEMALE_ #
1978       53.40    51.77  #    1253.71 1410296.49      1       1895     1.685   0.195
1979       59.81    57.80  #    1680.53 1303104.33      1       1666     2.149   0.143
         _NORTH___SOUTH_ #
1978       48.37    54.15  #   12381.56 1399168.65      1       1895    16.769   0.000
1979       58.11    59.10  #     327.47 1304457.38      1       1666     0.418   0.518
         PUBLIC_SEPARATE #
1978       53.39    49.36  #    4832.20 1406718.00      1       1895     6.509   0.011
1979       57.64    63.82  #    9904.54 1294880.31      1       1666    12.743   0.000


 ____COMPARING_THE_MEAN_SCORES_OF_PUPILS_WITHIN_ZONE_ONE_SUBGROUPS_____
                  GRADE: 6         STRAND:  GRAPHING
                                 ___________________F-TEST TABLE___________________
                                 # _________SS________  ______DF______
YEAR        SUBGROUP             #__BETWEEN_____WITHIN__BETWEEN_WITHIN__F-RATIO__PROB
=====  ================= #
         _EARLY___LATE__ #
1978       66.01    69.33  #    4392.38 2311127.99      1       1838     3.493   0.062
1979       76.35    78.90  #    2360.01 1396770.66      1       1572     2.656   0.103
         _MALE___FEMALE_ #
1978       66.49    67.45  #     436.76 2385256.88      1       1895     0.347   0.556
1979       76.81    76.94  #       6.09 1482819.77      1       1666     0.007   0.934
         _NORTH___SOUTH_ #
1978       66.14    67.25  #     458.01 2385235.63      1       1895     0.364   0.547
1979       75.42    77.43  #    1348.05 1481477.81      1       1666     1.516   0.219
         PUBLIC_SEPARATE #
1978       68.13    62.07  #   10925.24 2374768.40      1       1895     8.718   0.003
1979       75.85    81.18  #    7367.18 1475458.66      1       1666     8.319   0.004
```



THE HYPOTHESIS		THE STRANDS									
		NUMBER		OPER. & PROP.		MEASUREMENT		GEOMETRY		GRAPHING	
		1978	1979	1978	1979	1978	1979	1978	1979	1978	1979
3	EARLY										
	LATE	▨	▨	▨	▨	▨	▨	▨	▨		
4	MALE										
	FEMALE		▨	▨	▨						
5	NORTH										
	SOUTH	▨						▨			
6	PUBLIC	▨		▨		▨		▨		▨	
	SEPARATE								▨		▨

LEGEND

☐ Null Hypothesis Holds

▨ Null Hypothesis False

LATE ▨ Subgroup with Statistical Advantage

1978 ▨ Year of the Statistical Advantage

FIGURE 190

A CHART INDICATING WHICH SUBGROUPS IN
GRADE 6 HAVE STATISTICALLY HIGHER ACHIEVEMENT

have significantly higher mean scores in 1978 with the Separate school pupils making the greater gains for 1979. For the Geometry and Graphing strands in grade six, the achievement picture for 1978 and 1979 is reversed.

D. ANALYSIS OF THE QUESTIONNAIRE (Appendix B)

The Pearson-product-moment correlation coeficient was calculated between years of teaching experience and the ranking items from parts one and two of the questionnaire. For any correlation to be significant the Pearson coefficient had to reach at least the 0.5 level.

There were however no significant correlations between the years of teaching experience in the Zone and the likelihood of teachers choosing a particular factor. One reason for failing to obtain a significant correlation may have been the splitting of the sample into too many parts. Not only were teachers separated by grade level but also into ten experience categories. This predestined many of the cells to zero.

Section three of the questionnaire was not a ranking item. The Eta-squared test was utilized here to see if teaching experience was related to the choice of a particular factor.

Eta is a measure of association used when the independent variable is nominal level and the dependent variable is interval or ratio level. It is an asymmetric statistic that indicates how dissimilar the scores of the dependent variable (teaching experience) are within the categories of the independent variables (responses to factors). Eta-squared is interpreted as the proportion of variance in the dependent variable accounted for by the independent variable.

E. SECTION ONE OF THE QUESTIONNAIRE

The following factors were listed for teachers to rank as the most likely to be responsible for students within their school system not achieving within the 85-100 percent category. The numbering of the factors follows those of the actual questionnaire.

4. There is a lack of good materials for teaching certain objectives.
5. Textbooks do not match the program objectives.
6. The program objectives for my grade level are too difficult.
7. The test items for my grade level are too difficult.
8. The varied abilities of my students makes instruction difficult.
9. The sequencing of content in our textbook is inappropriate.
10. Keeping track of failure and successes and subsequent follow-up is too difficult.
11. Students fail to master objective because of inadequate learning skills (e.g., forgetting).

F. SECTION TWO OF THE QUESTIONNAIRE

Teachers were asked to rank the following factors as the most important to the least important contributors to a successful mathematics program for any school.

12. A instructional plan involving good teachable materials.
13. Textbooks that students like and which cover the program objectives.
14. A management plan that includes help for marking and ways and means of keeping track and following up with students.
15. A program that is geared to the ability levels of all children.
16. A classroom of children grouped so that their needs, abilities and interests are alike.
17. The professional training of the teachers in our system.
18. The continuous (inservice) education of teachers in our system in mathematics.

G. SECTION THREE OF THE QUESTIONNAIRE

The third section of the questionnaire dealt with the composite achievement of Zone One students who were tested in June of 1978. Figure 191 contains the lowest mean scores that were recorded within each strand for grades one through six. Teachers were asked to respond from the perspective of one particular grade and to choose one of the factors A-F as being primarily responsible for the score listed.

The factors from which teachers were to respond to by strand are listed below.

A. Students traditionally have difficulty with this topic.

B. The topic is new. Understanding will grow with teacher familiarity.

C. Students have not mastered previous concepts upon which this concept is dependent.

D. Instructional materials are lacking in this area.

E. This topic would not receive the instructional emphasis required for mastery.

F. This concept is beyond the ability of children at this particular grade level.

H. REPORTING OF THE QUESTIONNAIRE FINDING

As in the previous reporting sections of this study the findings will be given by grade level.

The column totals from the tables that follow will be used in choosing two most important and two least important factors from each of sections one and two of the questionnaire. The two highest and the two lowest column totals were used for determining the most and least

Grade One

Number	Oper. & Prop.	Measurement	Geometry	Graphing
5.Actually tests objective 6.renaming 72.7%	2.Symbolizes addit. & subt. sit. 73.9%	6.Recognizes coins & other values 68.3%	Mastery	1.Graphing data 78.6%

Grade Two

Number	Oper. & Prop.	Measurement	Geometry	Graphing
5.place value 65.1%	5.Solves picture & word problems 50.0%	4.Months in order 49.2%	3.Geometric pattern 75.0%	1.Construct bar & pictograph 69.4%

Grade Three

Number	Oper. & Prop.	Measurement	Geometry	Graphing
4.place value 45.4	9.solves word problems 56.0%	9.linear meas. to tenths 38.2%	4.Corresponding parts 48.8%	1.the axis 48.1%

Grade Four

Number	Oper. & Prop.	Measurement	Geometry	Graphing
8.tenths hundredths 9.6%	3.Rounding 37.0%	9.linear meas. to hundredths 12.8%	2.Axis of symmetry 44.4%	4.ordered pairs 45.6%

Grade Five

Number	Oper. & Prop.	Measurement	Geometry	Graphing
3.place value to 0.001 36.4%	6.Solve word problems 35.0%	9.equivalent measures 27.2%	2.Corresponding parts 38.2%	4.radius diam. & circumferences 41.8%

Grade Six

Number	Oper. & Prop.	Measurement	Geometry	Graphing
3.decimals & expanded notation 40.1%	6.Mult. & divides decimals 35.5	6.interrelationships 25.9	3.Constructs 3-D figures 43.7	2.ordered pairs 59.9

FIGURE 191

LOWEST 1978 ACHIEVEMENT SCORES
GRADES ONE TO SIX BY STRAND

important factors according to the teachers. Only the most frequent choice from section three will be listed as contributing to the lowest score by strand and grade level, that is unless two factors were given an equal rating.

Grade One

According to the grade one teachers the factors contributing to the lack of achievement within their respective school system in terms of students not reaching Category D (85-100 percent) are:

Most likely

5. Textbooks do not match the program objectives.
11. Students fail to master objectives because of inadequate learning skills (eg. forgetting).

Least likely

7. The test items for my grade level are too difficult.
6. The program objectives for my grade level are too difficult.

Concerning those factors which should contribute to a successful mathematics program grade one teachers choose the following:

Most important

12. An instructional plan involving good teachable materials.
15. A program that is geared to the ability levels of all children.

Least important

17. The professional training of the teachers in our

system.

16. A classroom of children grouped so that their needs, abilities and interests are alike.

Grade one teachers gave the following reasons for the low achievement scores that are recorded for grade one pupils in Figure 191.

Number

C. Students have not mastered previous concepts upon which this oncept is dependent.

Operations and Properties

C. Students have not mastered previous concepts upon which this concept was dependent.

Measurement

F. This concept is beyond the ability of children at this particular grade level.

Geometry Mastery Performance

Graphing

E. This topic would not receive the instructional emphasis required for mastery.

Grade Two

Grade two teachers gave the following reasons for the children in their school system not reaching the 85-100 percent achievement category.

Most likely

11. Student fail to master objectives because of inadequate learning skills (eg. forgetting).

TABLE 35

FREQUENCY OF GRADE ONE TEACHERS IN EXPERIENCE CATEGORIES, CHOOSING FACTORS THAT INFLUENCE NON-MASTERY PERFORMANCE

```
GRADE: ONE     STATEMENT:   5. Texbooks do not match the program objectives.
*************

       YEARS TEACHING #  MOST LIKELY. . . . . . . . . . . LEAST LIKELY  #   ROW
          ZONE ONE    #   1     2     3     4     5     6     7     8   #  TOTALS
       ##########################################################################
            1         #   1     0     0     0     1     0     1     0   #    3
            2         #   3     0     1     1     2     1     0     0   #    8
            3         #   0     0     1     1     0     0     0     1   #    3
            4         #   1     0     1     0     0     0     0     0   #    2
            5         #   1     4     0     0     0     0     0     0   #    5
            6         #   0     1     0     0     0     0     1     1   #    3
            7         #   0     0     0     0     0     0     0     1   #    1
            8         #   1     0     0     0     0     1     0     0   #    2
            9         #   0     1     0     0     0     0     0     0   #    1
         >= 10        #   4     3     1     1     0     4     1     0   #   14
       ===============#==================================================#========
       COLUMN TOTALS  #  11     9     4     3     3     6     3     3   #   42
                   Pearson r = -0.022       r-squared = 0.000
GRADE: ONE     STATEMENT:  11. Students fail to master objectives because of inadequate
*************                  learning skills (e.g., forgetting).

       YEARS TEACHING #  MOST LIKELY. . . . . . . . . . . LEAST LIKELY  #   ROW
          ZONE ONE    #   1     2     3     4     5     6     7     8   #  TOTALS
       ##########################################################################
            1         #   0     1     0     0     1     0     0     1   #    3
            2         #   2     1     0     1     3     0     0     1   #    8
            3         #   0     1     1     0     1     0     0     0   #    3
            4         #   0     1     0     1     0     0     0     1   #    3
            5         #   2     1     1     1     1     0     0     0   #    6
            6         #   1     1     0     0     1     0     0     0   #    3
            7         #   0     0     0     0     1     0     0     0   #    1
            8         #   0     1     0     1     0     0     0     0   #    2
            9         #   0     0     1     0     0     0     0     0   #    1
         >= 10        #   2     5     0     1     2     0     3     1   #   14
       ===============#==================================================#========
       COLUMN TOTALS  #   7    12     3     5    10     0     3     4   #   44
                   Pearson r = -0.038       r-squared = 0.001
GRADE: ONE     STATEMENT:   7. The test items for my grade level are too difficult.
*************

       YEARS TEACHING #  MOST LIKELY. . . . . . . . . . . LEAST LIKELY  #   ROW
          ZONE ONE    #   1     2     3     4     5     6     7     8   #  TOTALS
       ##########################################################################
            1         #   0     0     1     0     1     0     0     1   #    3
            2         #   0     3     0     1     1     0     3     0   #    8
            3         #   2     0     0     0     0     0     1     0   #    3
            4         #   0     0     0     0     0     3     0     1   #    4
            5         #   0     1     0     0     0     1     2     2   #    6
            6         #   0     0     0     1     0     1     0     1   #    3
            7         #   0     0     0     0     0     1     0     0   #    1
            8         #   0     0     0     0     0     0     1     1   #    2
            9         #   0     0     0     0     0     0     0     1   #    1
         >= 10        #   1     1     1     3     2     1     3     2   #   14
       ===============#==================================================#========
       COLUMN TOTALS  #   3     5     2     5     4     7    10     9   #   45
                   Pearson r =  0.106       r-squared = 0.011
GRADE: ONE     STATEMENT:   6. The program objectives for my grade level are too difficult.
*************

       YEARS TEACHING #  MOST LIKELY. . . . . . . . . . . LEAST LIKELY  #   ROW
          ZONE ONE    #   1     2     3     4     5     6     7     8   #  TOTALS
       ##########################################################################
            1         #   0     2     1     0     0     0     0     0   #    3
            2         #   1     0     0     2     0     2     0     3   #    8
            3         #   0     0     0     1     0     1     0     1   #    3
            4         #   1     0     0     1     0     1     0     1   #    4
            5         #   0     1     0     0     1     2     1     1   #    6
            6         #   0     0     0     0     1     0     1     1   #    3
            7         #   0     0     0     0     0     0     0     1   #    1
            8         #   0     0     1     0     0     0     1     0   #    2
            9         #   0     0     0     0     0     1     0     0   #    1
         >= 10        #   0     1     1     4     2     2     1     3   #   14
       ===============#==================================================#========
       COLUMN TOTALS  #   2     4     3     8     4     9     4    11   #   45
                   Pearson r =  0.104       r-squared = 0.011
```

TABLE 36

FREQUENCIES OF GRADE ONE TEACHERS IN EXPERIENCE CATEGORIES CHOOSING FACTORS THAT INFLUENCE GOOD MATHEMATICS PROGRAMS

```
GRADE: ONE     STATEMENT:  12. A instructional plan involving good teachable materials.
************

        YEARS TEACHING *  MOST IMPORTANT. . . . . LEAST IMPORTANT  *   ROW
          ZONE ONE     *   1     2     3     4     5     6     7  *  TOTALS
        ***************************************************************
            1          *   1     1     1     0     0     0     0  *    3
            2          *   3     4     0     0     1     0     0  *    8
            3          *   1     0     1     0     1     0     0  *    3
            4          *   2     1     1     0     0     0     0  *    4
            5          *   1     2     0     2     0     0     1  *    6
            6          *   0     2     0     1     0     0     0  *    3
            7          *   1     0     0     0     0     0     0  *    1
            8          *   1     0     0     0     1     0     0  *    2
            9          *   0     1     0     0     0     0     0  *    1
          >=  10       *   2     4     3     3     2     0     0  *   14
        ===============*=========================================*========
        COLUMN TOTALS  *  12    15     6     6     5     0     1  *   45
                    Pearson r =  0.199      r-squared = 0.040
GRADE: ONE     STATEMENT:  15. A program that is geared to the ability levels of all children.
************

        YEARS TEACHING *  MOST IMPORTANT. . . . . LEAST IMPORTANT  *   ROW
          ZONE ONE     *   1     2     3     4     5     6     7  *  TOTALS
        ***************************************************************
            1          *   1     0     0     1     0     0     1  *    3
            2          *   4     0     1     2     1     0     0  *    8
            3          *   1     2     0     0     0     0     0  *    3
            4          *   2     0     1     1     0     0     0  *    4
            5          *   2     1     1     0     1     1     0  *    6
            6          *   2     1     0     0     0     0     0  *    3
            7          *   1     0     0     0     0     0     0  *    1
            8          *   1     1     0     0     0     0     0  *    2
            9          *   1     0     0     0     0     0     0  *    1
          >=  10       *   4     0     1     3     3     1     2  *   14
        ===============*=========================================*========
        COLUMN TOTALS  *  19     5     4     7     5     2     3  *   45
                    Pearson r =  0.178      r-squared = 0.032
GRADE: ONE     STATEMENT:  17. The professional training of the teachier in our system.
************

        YEARS TEACHING *  MOST IMPORTANT. . . . . LEAST IMPORTANT  *   ROW
          ZONE ONE     *   1     2     3     4     5     6     7  *  TOTALS
        ***************************************************************
            1          *   0     0     0     0     2     0     1  *    3
            2          *   3     0     1     0     1     3     0  *    8
            3          *   2     0     0     0     0     1     0  *    3
            4          *   1     0     0     0     1     0     2  *    4
            5          *   0     0     2     0     1     1     2  *    6
            6          *   0     0     0     1     1     1     0  *    3
            7          *   0     0     0     0     0     0     0  *    0
            8          *   0     1     0     0     0     0     1  *    2
            9          *   0     0     0     0     0     1     0  *    1
          >=  10       *   3     0     0     0     2     5     4  *   14
        ===============*=========================================*========
        COLUMN TOTALS  *   9     1     3     1     8    12    10  *   44
                    Pearson r =  0.175      r-squared = 0.031

GRADE: ONE     STATEMENT:  16. A class room of children grouped so that their needs, abilities
************                   and interests are alike.

        YEARS TEACHING *  MOST IMPORTANT. . . . . LEAST IMPORTANT  *   ROW
          ZONE ONE     *   1     2     3     4     5     6     7  *  TOTALS
        ***************************************************************
            1          *   0     1     1     0     0     0     1  *    3
            2          *   1     2     0     1     0     0     3  *    7
            3          *   2     0     0     0     0     0     1  *    3
            4          *   0     1     1     0     1     1     0  *    4
            5          *   1     0     0     1     0     3     1  *    6
            6          *   0     1     0     0     1     0     1  *    3
            7          *   1     0     0     0     0     0     0  *    1
            8          *   0     0     0     1     0     0     1  *    2
            9          *   0     0     0     0     0     0     1  *    1
          >=  10       *   1     2     0     1     3     5     2  *   14
        ===============*=========================================*========
        COLUMN TOTALS  *   6     7     2     4     5     9    11  *   44
                    Pearson r =  0.176      r-squared = 0.031
```

GRADE: ONE STATEMENT: 19. Number

YEARS TEACHING ZONE ONE	REASONS FOR LOW STRAND MARKS						ROW TOTALS
	A	B	C	D	E	F	
1	0	1	1	0	1	0	3
2	0	1	1	0	2	4	8
3	0	1	1	0	0	1	3
4	0	1	1	1	0	1	4
5	1	1	1	1	0	0	4
6	1	0	0	0	2	0	3
7	1	0	0	0	0	0	1
8	0	0	0	0	2	0	2
9	0	0	1	0	0	0	1
>= 10	2	2	4	0	3	0	11
COLUMN TOTALS	5	7	10	2	10	6	40

Eta-squared = 0.215

GRADE: ONE STATEMENT: 20. Operations and Properties

YEARS TEACHING ZONE ONE	REASONS FOR LOW STRAND MARKS						ROW TOTALS
	A	B	C	D	E	F	
1	0	0	2	0	0	0	2
2	2	1	3	0	1	1	8
3	0	2	0	0	0	0	2
4	1	0	1	0	1	1	4
5	0	2	1	1	0	0	4
6	0	0	1	0	1	0	2
7	0	0	0	1	0	0	1
8	1	0	0	1	0	0	2
9	0	0	1	0	0	0	1
>= 10	4	2	4	0	0	1	11
COLUMN TOTALS	8	7	13	3	3	3	37

Eta-squared = 0.064

GRADE: ONE STATEMENT: 21. Measurement

YEARS TEACHING ZONE ONE	REASONS FOR LOW STRAND MARKS						ROW TOTALS
	A	B	C	D	E	F	
1	0	0	0	0	0	1	1
2	4	1	1	0	1	1	8
3	0	0	0	0	1	2	3
4	1	0	1	0	0	2	4
5	0	1	1	0	1	1	4
6	2	0	0	1	0	0	3
7	0	0	0	1	0	0	1
8	1	0	0	0	0	1	2
9	0	0	0	0	0	0	0
>= 10	2	0	1	3	4	3	13
COLUMN TOTALS	10	2	4	5	7	11	39

Eta-squared = 0.151

GRADE: ONE STATEMENT: 22. Geometry

YEARS TEACHING ZONE ONE	REASONS FOR LOW STRAND MARKS						ROW TOTALS
	A	B	C	D	E	F	
1	0	1	0	0	0	0	1
2	0	1	2	0	1	0	4
3	0	0	0	1	0	0	1
4	0	1	1	1	0	0	3
5	0	0	1	1	0	0	2
6	0	0	0	1	1	1	3
7	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0
9	1	0	0	0	0	0	1
>= 10	1	2	0	2	0	0	5
COLUMN TOTALS	2	5	4	6	2	1	20

Eta-squared = 0.311

GRADE: ONE STATEMENT: 23. Graphing

YEARS TEACHING ZONE ONE	REASONS FOR LOW STRAND MARKS						ROW TOTALS
	A	B	C	D	E	F	
1	0	0	1	0	0	0	1
2	0	1	0	1	4	2	8
3	0	1	0	0	2	0	3
4	0	0	1	1	1	1	4
5	0	1	0	2	2	0	5
6	0	2	0	0	0	0	2
7	1	0	0	0	0	0	1
8	0	0	0	0	1	1	2
9	0	0	0	0	0	0	0
>= 10	1	1	0	4	4	2	12
COLUMN TOTALS	2	6	2	8	14	6	38

Eta-squared = 0.128

TABLE 37

FREQUENCIES OF GRADE ONE TEACHERS
IN EXPERIENCE CATEGORIES CHOOSING
REASONS FOR LOWEST MEANS BY STRAND .

5. Textbooks do not match the program objectives.

Least likely

6. The program objectives for my grade are too difficult.

7. The test items for my grade level are too difficult.

Concerning those factors that influence the successful operation of a mathematics program in any school, grade two teachers responded with the following:

Most important

12. An instructional plan involving good teachable materials.

15. A program that is geared to the ability levels of all children.

Least important

16. A classroom of children grouped so that their needs, abilities and interests are alike.

17. The professional training of the teachers in our system.

Regarding the low achievement scores in grade two (Figure 191) teachers gave the following reasons by strand.

Number

C. Students have not mastered the previous concepts upon which this concept is dependent.

Operations and Properties

C. Students have not mastered the previous concepts upon which this concept is dependent.

Measurement

TABLE 38

FREQUENCIES OF GRADE TWO TEACHERS IN EXPERIENCE CATEGORIES CHOOSING FACTORS THAT INFLUENCE NON-MASTERY PERFORMANCE

GRADE: TWO STATEMENT: 11. Students fail to master objectives because of inadequate learning skills (e.g., forgetting).

YEARS TEACHING ZONE ONE	MOST LIKELY. . . . . LEAST LIKELY								ROW TOTALS
	1	2	3	4	5	6	7	8	
1	2	0	0	0	0	0	0	0	2
2	0	1	2	2	1	0	0	0	6
3	1	1	0	0	0	1	0	0	3
4	0	2	1	0	2	1	0	0	6
5	2	0	0	1	0	0	0	0	3
6	1	1	0	2	1	0	0	1	6
7	0	0	0	0	0	0	0	0	0
8	1	0	0	0	0	0	0	0	1
9	0	1	0	0	1	0	1	0	3
>= 10	3	1	2	1	3	0	1	0	11
COLUMN TOTALS	10	7	5	6	8	2	2	1	41

Pearson r = 0.116 r-squared = 0.013

GRADE: TWO STATEMENT: 5. Textbooks do not match the program objectives.

YEARS TEACHING ZONE ONE	MOST LIKELY. . . . . LEAST LIKELY								ROW TOTALS
	1	2	3	4	5	6	7	8	
1	0	0	0	0	2	0	0	0	2
2	1	0	1	0	1	0	3	0	6
3	2	0	1	0	0	0	0	0	3
4	1	2	0	1	0	1	0	1	6
5	0	2	0	0	1	0	0	0	3
6	1	0	0	1	1	1	1	0	5
7	0	0	0	0	0	0	0	0	0
8	0	0	0	0	1	0	0	0	1
9	0	0	0	1	0	0	0	2	3
>= 10	4	3	2	0	0	2	0	0	11
COLUMN TOTALS	9	7	4	3	6	4	4	3	40

Pearson r = -0.156 r-squared = 0.024

GRADE: TWO STATEMENT: 6. The program objectives for my grade level are too difficult.

YEARS TEACHING ZONE ONE	MOST LIKELY. . . . . LEAST LIKELY								ROW TOTALS
	1	2	3	4	5	6	7	8	
1	0	0	0	0	0	0	0	2	2
2	0	0	0	1	1	2	0	2	6
3	0	0	0	0	0	0	1	2	3
4	1	0	0	2	0	0	0	3	6
5	0	0	0	0	0	0	2	1	3
6	0	0	0	0	2	1	2	1	6
7	0	0	0	0	0	0	0	1	1
8	0	0	0	0	0	0	1	0	1
9	0	0	1	0	0	0	1	1	3
>= 10	0	1	0	1	0	3	3	3	11
COLUMN TOTALS	1	1	1	4	3	6	10	16	42

Pearson r = -0.086 r-squared = 0.037

GRADE: TWO STATEMENT: 7. The test items for my grade level are too difficult.

YEARS TEACHING ZONE ONE	MOST LIKELY. . . . . LEAST LIKELY								ROW TOTALS
	1	2	3	4	5	6	7	8	
1	0	0	0	0	0	0	1	1	2
2	0	0	0	0	2	1	2	1	6
3	0	0	0	0	0	1	0	2	3
4	0	1	0	0	2	0	3	0	6
5	0	0	0	0	0	1	1	1	3
6	0	0	0	2	1	0	2	1	6
7	0	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	1	1
9	0	0	1	1	0	1	0	0	3
>= 10	0	3	0	2	0	2	4	0	11
COLUMN TOTALS	0	4	1	5	5	6	13	7	41

Pearson r = -0.367 r-squared = 0.149

TABLE 39

FREQUENCIES OF GRADE TWO TEACHERS IN EXPERIENCE CATEGORIES CHOOSING FACTORS THAT INFLUENCE GOOD MATHEMATICS PROGRAMS

```
GRADE: TWO     STATEMENT:  12. A instructional plan involving good teachable materials.
*************

        YEARS TEACHING #  MOST IMPORTANT. . . . . LEAST IMPORTANT  #   ROW
           ZONE ONE    #   1     2     3     4     5     6     7  #  TOTALS
        ##############################################################
              1        #   1     0     0     1     0     0     0  #    2
              2        #   1     0     2     1     1     1     0  #    6
              3        #   2     0     0     0     0     1     0  #    3
              4        #   3     3     0     0     0     0     0  #    6
              5        #   2     0     0     1     0     0     0  #    3
              6        #   0     2     2     0     1     0     0  #    5
              7        #   0     0     0     0     0     0     0  #    0
              8        #   0     1     0     0     0     0     0  #    1
              9        #   3     0     0     0     0     0     0  #    3
            >= 10      #   3     3     2     1     1     0     1  #   11
        ===============#==========================================#========
        COLUMN TOTALS  #  15     9     6     4     3     2     1  #   40
                        Pearson r = -0.078      r-squared = 0.005
GRADE: TWO     STATEMENT:  15. A program that is geared to the ability levels of all children.
*************

        YEARS TEACHING #  MOST IMPORTANT. . . . . LEAST IMPORTANT  #   ROW
           ZONE ONE    #   1     2     3     4     5     6     7  #  TOTALS
        ##############################################################
              1        #   1     0     1     0     0     0     0  #    2
              2        #   0     2     3     0     0     1     0  #    6
              3        #   0     1     0     0     1     1     0  #    3
              4        #   2     1     1     2     0     0     0  #    6
              5        #   1     1     0     0     1     0     0  #    3
              6        #   4     0     0     1     1     0     0  #    6
              7        #   1     0     0     0     0     0     0  #    1
              8        #   1     0     0     0     0     0     0  #    1
              9        #   0     1     1     0     0     1     0  #    3
            >= 10      #   3     2     2     0     1     2     0  #   10
        ===============#==========================================#========
        COLUMN TOTALS  #  13     8     8     3     4     5     0  #   41
                        Pearson r = -0.001      r-squared = 0.000
GRADE: TWO     STATEMENT:  16. A class room of children grouped so that their needs, abilities
*************                  and interests are alike.

        YEARS TEACHING #  MOST IMPORTANT. . . . . LEAST IMPORTANT  #   ROW
           ZONE ONE    #   1     2     3     4     5     6     7  #  TOTALS
        ##############################################################
              1        #   1     0     0     0     0     0     1  #    2
              2        #   1     0     0     1     1     1     2  #    6
              3        #   0     0     0     1     0     0     1  #    2
              4        #   0     0     1     1     2     2     0  #    6
              5        #   0     0     0     1     1     0     1  #    3
              6        #   0     0     1     1     0     4     0  #    6
              7        #   0     0     0     0     0     0     0  #    0
              8        #   0     0     0     0     0     1     0  #    1
              9        #   0     1     0     0     1     0     1  #    3
            >= 10      #   1     1     3     1     0     2     3  #   11
        ===============#==========================================#========
        COLUMN TOTALS  #   3     2     5     6     5    10     9  #   40
                        Pearson r = -0.073      r-squared = 0.005

GRADE: TWO     STATEMENT:  17. The professional training of the teachier in our system.
*************

        YEARS TEACHING #  MOST IMPORTANT. . . . . LEAST IMPORTANT  #   ROW
           ZONE ONE    #   1     2     3.    4     5     6     7  #  TOTALS
        ##############################################################
              1        #   2     0     0     0     0     0     0  #    2
              2        #   1     0     1     0     1     2     1  #    6
              3        #   0     2     0     0     0     1     0  #    3
              4        #   0     0     0     2     1     0     3  #    6
              5        #   0     0     0     0     0     3     0  #    3
              6        #   0     1     1     3     0     0     1  #    6
              7        #   0     0     0     0     0     0     0  #    0
              8        #   0     0     0     0     1     0     0  #    1
              9        #   0     1     0     2     0     0     0  #    3
            >= 10      #   1     1     1     0     1     2     5  #   11
        ===============#==========================================#========
        COLUMN TOTALS  #   4     5     3     7     4     8    10  #   41
                        Pearson r =  0.182      r-squared = 0.033
```

```
GRADE: TWO     STATEMENT:  19. Number
*************

      YEARS TEACHING *    REASONS FOR LOW STRAND MARKS      *   ROW
         ZONE ONE    *   A     B     C     D     E     F    *  TOTALS
      ***********************************************************************
            1        *   0     1     1     0     0     0    *    2
            2        *   1     0     2     0     1     1    *    5
            3        *   1     0     1     0     0     0    *    2
            4        *   0     1     3     0     1     1    *    6
            5        *   1     0     2     0     0     0    *    3
            6        *   1     1     2     1     0     1    *    6
            7        *   1     0     0     0     0     0    *    1
            8        *   0     0     0     0     1     0    *    1
            9        *   1     0     1     0     0     1    *    3
         >= 10       *   4     0     5     0     2     0    *   11
      ===============*======================================*========
      COLUMN TOTALS  *  10     3    17     1     5     4    *   40
                       Eta-squared =  0.093
GRADE: TWO     STATEMENT:  20. Operations and Properties
*************

      YEARS TEACHING *    REASONS FOR LOW STRAND MARKS      *   ROW
         ZONE ONE    *   A     B     C     D     E     F    *  TOTALS
      ***********************************************************************
            1        *   0     0     1     0     0     0    *    1
            2        *   1     0     1     0     2     1    *    5
            3        *   0     0     2     1     0     0    *    3
            4        *   2     1     2     0     1     0    *    6
            5        *   1     0     1     0     0     0    *    2
            6        *   1     0     1     1     1     2    *    6
            7        *   1     0     0     0     0     0    *    1
            8        *   0     0     1     0     0     0    *    1
            9        *   0     0     1     0     2     0    *    3
         >= 10       *   3     0     4     1     3     0    *   11
      ===============*======================================*========
      COLUMN TOTALS  *   9     1    14     3     9     3    *   39
                       Eta-squared =  0.047
GRADE: TWO     STATEMENT:  21. Measurement
*************

      YEARS TEACHING *    REASONS FOR LOW STRAND MARKS      *   ROW
         ZONE ONE    *   A     B     C     D     E     F    *  TOTALS
      ***********************************************************************
            1        *   0     1     0     0     1     0    *    2
            2        *   0     0     0     0     4     1    *    5
            3        *   0     0     1     2     0     0    *    3
            4        *   1     3     1     0     0     1    *    6
            5        *   1     0     1     0     0     0    *    2
            6        *   0     3     0     1     1     1    *    6
            7        *   0     1     0     0     0     0    *    1
            8        *   0     0     1     0     0     0    *    1
            9        *   0     2     0     1     0     0    *    3
         >= 10       *   1     1     1     1     7     0    *   11
      ===============*======================================*========
      COLUMN TOTALS  *   3    11     5     5    13     3    *   40
                       Eta-squared =  0.041
```

```
GRADE: TWO     STATEMENT:  22. Geometry
*************

      YEARS TEACHING *    REASONS FOR LOW STRAND MARKS      *   ROW
         ZONE ONE    *   A     B     C     D     E     F    *  TOTALS
      ***********************************************************************
            1        *   0     1     1     0     0     0    *    2
            2        *   0     0     1     1     2     1    *    5
            3        *   0     1     1     0     1     0    *    3
            4        *   0     0     1     3     1     0    *    5
            5        *   0     0     0     0     2     0    *    2
            6        *   0     0     1     1     3     1    *    6
            7        *   0     0     0     1     0     0    *    1
            8        *   0     0     0     0     1     0    *    1
            9        *   0     0     1     1     1     0    *    3
         >= 10       *   1     2     2     1     5     0    *   11
      ===============*======================================*========
      COLUMN TOTALS  *   1     4     8     8    16     2    *   39
                       Eta-squared =  0.081

GRADE: TWO     STATEMENT:  23. Graphing
*************

      YEARS TEACHING *    REASONS FOR LOW STRAND MARKS      *   ROW
         ZONE ONE    *   A     B     C     D     E     F    *  TOTALS
      ***********************************************************************
            1        *   0     0     1     0     0     0    *    1
            2        *   0     1     1     0     3     0    *    5
            3        *   0     0     0     0     3     0    *    3
            4        *   0     0     0     2     3     0    *    5
            5        *   0     0     0     0     2     0    *    2
            6        *   0     0     0     4     1     1    *    6
            7        *   0     0     0     1     0     0    *    1
            8        *   0     0     0     0     1     0    *    1
            9        *   0     0     1     0     2     0    *    3
         >= 10       *   1     1     2     1     6     0    *   11
      ===============*======================================*========
      COLUMN TOTALS  *   1     2     5     8    21     1    *   38
                       Eta-squared =  0.041
```

TABLE 40

FREQUENCIES OF GRADE TWO TEACHERS
IN EXPERIENCE CATEGORIES CHOOSING
REASONS FOR LOWEST MEANS BY STRAND

E. This topic would not receive the instructional emphasis required for mastery.

Geometry

E. This topic would not receive the instructional emphasis required for mastery.

Graphing

E. This topic would not receive the instructional emphasis required for mastery.

Grade Three

Grade three teachers cited the following as the most and least likely influences for children within their schools not reaching the 85-100 percent achievement category:

Most likely

5. Textbooks do not match the program objectives.
11. Students fail to master objectives because of inadequate learning skills.

Least likely

9. The sequencing of content in our textbook is inappropriate.
10. Keeping track of failure and successes and subsequent follow-up is too difficult.

With regard to the most likely it appears as though teachers with more than five years of experience in the zone were more likely to choose the textbook mismatch as the most likely factor while the teachers with less experience favored the inadequate learning skills factor.

With regard to the contributing factors to a good mathematics program, grade three teachers chose the following:

Most important

15. A program that is geared to the ability levels of all children.
12. An instructional plan involving good teachable materials.

Least important

17. The professional training of teachers in our system.
18. The continuous (inservice) education of teachers in our system in mathematics.

The influences which these teachers considered to be most responsible for the low achievement scores in the grade three strands were as follows:

Number

C. Students have not mastered previous concepts upon which this concept is dependent.

Operations and Properties

C. Students have not mastered previous concepts upon which this concept is dependent.

Measurement

E. This topic would not receive the instructional emphasis required for mastery.

Geometry

E. The topic would not receive the instructional

TABLE 41

FREQUENCIES OF GRADE THREE TEACHERS IN EXPERIENCE CATEGORIES CHOOSING FACTORS THAT INFLUENCE NON-MASTERY PERFORMANCE

GRADE: THREE STATEMENT: 5. Texbooks do not match the program objectives.

YEARS TEACHING	MOST LIKELY.						LEAST LIKELY	ROW
ZONE ONE	1	2	3	4	5	6	7	8	TOTALS
1	1	3	0	2	0	0	1	1	8
2	1	1	1	3	0	0	1	0	7
3	1	0	2	1	0	0	0	1	5
4	0	0	0	0	1	0	0	0	1
5	0	1	0	0	0	0	1	0	2
6	1	1	1	0	0	0	1	0	4
7	0	0	0	0	0	0	0	0	0
8	1	0	0	0	0	0	0	0	1
9	0	0	1	0	2	0	0	1	4
>= 10	5	3	0	4	0	1	1	0	14
COLUMN TOTALS	10	9	5	10	3	1	5	3	46

Pearson r = -0.110 r-squared = 0.012

GRADE: THREE STATEMENT: 11. Students fail to master objectives because of inadequate learning skills (e.g., forgetting).

YEARS TEACHING	MOST LIKELY.						LEAST LIKELY	ROW
ZONE ONE	1	2	3	4	5	6	7	8	TOTALS
1	6	0	0	1	0	0	0	1	8
2	2	2	2	0	0	0	0	1	7
3	4	0	0	1	0	0	0	0	5
4	0	0	0	1	0	0	0	0	1
5	0	0	2	0	0	0	0	0	2
6	2	0	1	0	1	0	0	0	4
7	0	0	0	0	0	0	0	0	0
8	0	0	1	0	0	0	0	0	1
9	1	0	2	0	0	0	0	1	4
>= 10	1	4	0	3	2	0	2	2	14
COLUMN TOTALS	16	6	8	6	3	0	2	5	46

Pearson r = 0.361 r-squared = 0.131

GRADE: THREE STATEMENT: 9. The sequencing of content in our textbooks is inappropriate.

YEARS TEACHING	MOST LIKELY.						LEAST LIKELY	ROW
ZONE ONE	1	2	3	4	5	6	7	8	TOTALS
1	0	0	0	0	2	5	1	0	8
2	0	1	0	0	0	0	4	2	7
3	0	0	0	2	1	1	1	0	5
4	0	0	0	0	0	0	0	1	1
5	0	0	0	0	0	0	0	2	2
6	0	1	0	0	0	0	1	2	4
7	0	0	0	0	0	0	0	0	0
8	0	1	0	0	0	0	0	0	1
9	0	0	1	2	0	0	0	1	4
>= 10	1	2	4	2	1	0	2	2	14
COLUMN TOTALS	1	5	5	6	4	6	9	10	46

Pearson r = -0.376 r-squared = 0.141

GRADE: THREE STATEMENT: 10. Keeping track of failure and successes and subsequent follow-up is too difficult.

YEARS TEACHING	MOST LIKELY.						LEAST LIKELY	ROW
ZONE ONE	1	2	3	4	5	6	7	8	TOTALS
1	0	0	0	0	3	0	3	2	8
2	2	0	1	0	2	0	0	2	7
3	0	0	0	0	1	3	0	1	5
4	0	0	0	1	0	0	0	0	1
5	0	0	0	0	0	2	0	0	2
6	0	0	1	0	1	0	1	1	4
7	0	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	1	1
9	0	2	0	1	0	0	1	0	4
>= 10	1	1	2	2	0	3	0	5	14
COLUMN TOTALS	3	3	4	4	7	8	5	12	46

Pearson r = -0.117 r-squared = 0.014

TABLE 42

FREQUENCIES OF GRADE THREE TEACHERS IN EXPERIENCE CATEGORIES CHOOSING FACTORS THAT INFLUENCE GOOD MATHEMATICS PROGRAMS

GRADE: THREE STATEMENT: 15. A program that is geared to the ability levels of all children.

YEARS TEACHING	MOST IMPORTANT. . . . . LEAST IMPORTANT							ROW
ZONE ONE	1	2	3	4	5	6	7	TOTALS
1	2	3	3	0	0	0	0	8
2	2	2	0	2	1	0	0	7
3	1	1	1	1	1	0	0	5
4	0	0	0	0	0	1	0	1
5	1	1	0	0	0	0	0	2
6	1	1	0	0	1	1	0	4
7	0	0	0	0	0	0	0	0
8	0	0	0	0	0	1	0	1
9	1	0	1	0	2	0	0	4
>= 10	5	0	3	3	1	2	0	14
COLUMN TOTALS	13	8	8	6	6	5	0	46

Pearson r = 0.192 r-squared = 0.037

GRADE: THREE STATEMENT: 12. A instructional plan involving good teachable materials.

YEARS TEACHING	MOST IMPORTANT. . . . . LEAST IMPORTANT							ROW
ZONE ONE	1	2	3	4	5	6	7	TOTALS
1	1	1	1	3	1	1	0	8
2	2	0	4	1	0	0	0	7
3	0	3	1	0	1	0	0	5
4	1	0	0	0	0	0	0	1
5	1	0	1	0	0	0	0	2
6	0	2	2	0	0	0	0	4
7	0	0	0	0	0	0	0	0
8	0	0	1	0	0	0	0	1
9	0	1	0	3	0	0	0	4
>= 10	3	5	2	1	0	0	3	14
COLUMN TOTALS	8	12	12	8	2	1	3	46

Pearson r = 0.036 r-squared = 0.001

GRADE: THREE STATEMENT: 17. The professional training of the teachier in our system.

YEARS TEACHING	MOST IMPORTANT. . . . . LEAST IMPORTANT							ROW
ZONE ONE	1	2	3	4	5	6	7	TOTALS
1	1	0	1	3	0	2	1	8
2	1	0	0	0	1	4	1	7
3	1	0	0	2	1	0	0	4
4	0	0	0	0	0	0	1	1
5	0	1	0	0	0	1	0	2
6	0	0	0	0	0	1	3	4
7	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	1	1
9	1	0	1	1	0	0	1	4
>= 10	1	0	3	1	2	2	4	13
COLUMN TOTALS	5	1	5	7	4	10	12	44

Pearson r = 0.048 r-squared = 0.002

GRADE: THREE STATEMENT: 18. The continuous (inservice) education of teachers in our system in mathematics.

YEARS TEACHING	MOST IMPORTANT. . . . . LEAST IMPORTANT							ROW
ZONE ONE	1	2	3	4	5	6	7	TOTALS
1	2	1	0	0	0	4	1	8
2	0	1	1	0	1	2	2	7
3	0	0	2	1	0	1	1	5
4	1	0	0	0	0	0	0	1
5	0	0	0	0	1	0	1	2
6	0	0	0	2	0	2	0	4
7	0	0	0	0	0	0	0	0
8	0	0	0	0	1	0	0	1
9	0	1	0	1	0	1	1	4
>= 10	1	3	1	1	2	4	2	14
COLUMN TOTALS	4	6	4	5	5	14	8	46

Pearson r = -0.025 r-squared = 0.001

```
GRADE: THREE   STATEMENT:  19. Number
*************

     YEARS TEACHING #    REASONS FOR LOW STRAND MARKS      #   ROW
        ZONE ONE    #   A     B     C     D     E     F    #  TOTALS
     ##################################################################
           1        #   0     0     3     2     1     0    #    6
           2        #   1     0     6     0     0     0    #    7
           3        #   0     0     4     0     0     0    #    4
           4        #   0     0     1     0     0     0    #    1
           5        #   0     0     1     0     0     1    #    2
           6        #   1     0     0     0     1     0    #    2
           7        #   0     0     0     0     0     0    #    0
           8        #   0     0     0     0     1     0    #    1
           9        #   2     1     1     0     0     0    #    4
        >= 10       #   1     0     9     1     0     2    #   13
     ------------------------------------------------------------------
     COLUMN TOTALS  #   5     1    25     3     3     3    #   40
                    Eta-squared =  0.100
GRADE: THREE   STATEMENT:  20. Operations and Properties
*************

     YEARS TEACHING #    REASONS FOR LOW STRAND MARKS      #   ROW
        ZONE ONE    #   A     B     C     D     E     F    #  TOTALS
     ##################################################################
           1        #   1     0     4     1     1     0    #    7
           2        #   3     1     2     1     0     0    #    7
           3        #   0     1     3     0     0     0    #    4
           4        #   0     1     0     0     0     0    #    1
           5        #   1     0     1     0     0     0    #    2
           6        #   0     0     1     0     1     0    #    2
           7        #   0     0     0     0     0     0    #    0
           8        #   0     0     0     1     0     0    #    1
           9        #   2     0     2     0     0     0    #    4
        >= 10       #   2     0     5     2     5     0    #   14
     ------------------------------------------------------------------
     COLUMN TOTALS  #   9     3    18     5     7     0    #   42
                    Eta-squared =  0.114
GRADE: THREE   STATEMENT:  21. Measurement
*************

     YEARS TEACHING #    REASONS FOR LOW STRAND MARKS      #   ROW
        ZONE ONE    #   A     B     C     D     E     F    #  TOTALS
     ##################################################################
           1        #   1     1     1     1     0     1    #    5
           2        #   1     0     1     3     2     0    #    7
           3        #   0     1     2     0     2     0    #    5
           4        #   0     0     0     0     1     0    #    1
           5        #   0     0     0     0     1     0    #    1
           6        #   0     1     0     0     1     1    #    3
           7        #   0     0     0     0     0     0    #    0
           8        #   0     1     0     0     0     0    #    1
           9        #   0     2     0     1     1     0    #    4
        >= 10       #   2     2     1     1     3     5    #   14
     ------------------------------------------------------------------
     COLUMN TOTALS  #   4     8     5     6    11     7    #   41
                    Eta-squared =  0.148
```

```
GRADE: THREE   STATEMENT:  22. Geometry
*************

     YEARS TEACHING #    REASONS FOR LOW STRAND MARKS      #   ROW
        ZONE ONE    #   A     B     C     D     E     F    #  TOTALS
     ##################################################################
           1        #   0     1     0     0     4     1    #    6
           2        #   0     2     0     0     5     0    #    7
           3        #   0     1     1     0     2     0    #    4
           4        #   0     0     0     0     1     0    #    1
           5        #   0     0     1     0     1     0    #    2
           6        #   0     1     0     2     1     0    #    4
           7        #   0     0     0     0     0     0    #    0
           8        #   0     0     0     0     0     1    #    1
           9        #   0     0     1     1     2     0    #    4
        >= 10       #   0     4     2     1     5     2    #   14
     ------------------------------------------------------------------
     COLUMN TOTALS  #   0     9     5     4    21     4    #   43
                    Eta-squared =  0.094
GRADE: THREE   STATEMENT:  23. Graphing
*************

     YEARS TEACHING #    REASONS FOR LOW STRAND MARKS      #   ROW
        ZONE ONE    #   A     B     C     D     E     F    #  TOTALS
     ##################################################################
           1        #   0     0     0     3     3     0    #    6
           2        #   0     0     0     2     5     0    #    7
           3        #   1     1     0     0     1     0    #    3
           4        #   0     1     0     0     0     0    #    1
           5        #   0     0     1     0     1     0    #    2
           6        #   0     0     0     0     3     0    #    3
           7        #   0     0     0     0     0     0    #    0
           8        #   0     0     0     1     0     0    #    1
           9        #   0     1     0     3     0     0    #    4
        >= 10       #   0     3     1     3     4     2    #   13
     ------------------------------------------------------------------
     COLUMN TOTALS  #   1     6     2    12    17     2    #   40
                    Eta-squared =  0.171
```

TABLE 43

FREQUENCIES OF GRADE THREE TEACHERS IN EXPERIENCE CATEGORIES CHOOSING REASONS FOR LOWEST MEANS BY STRAND emphasis required for mastery.

Graphing

E. This topic would not receive the instructional emphasis required for mastery.

Grade Four

Grade four teachers gave the following factors as the most and the least likely causes for students within their school system not achieving to the 85-100 percent level.

Most likely

8. The varied ability of my students makes instruction difficult.

11. Students fail to master objectives because of inadequate learning skills (eg. forgetting).

Least likely

10. Keeping track of failures and successes and subsequent follow-up is too difficult.

6. The program objectives for my grade are too difficult.

The teachers with the least experience frequently chose the varied abilities factor as the most likely contributor while the more experienced teachers favored the inadequate learning skills aspect.

When considering those aspects which are important to the operation of a good mathematics program, grade four teachers chose the following:

Most important

12. An instructional plan involving good teaching materials.
13. Textbooks that students like and which cover the program objectives.

Least important

16. A classroom of children grouped so that their needs, abilities and interests are alike.
17. The professional training of teachers in our system.

The grade four instructional people responded to these factors as the main cause for the low scores in the strands (Figure 191).

Number

C. Student have not mastered previous concepts upon which this concept is dependent.
F. This concept is beyond the ability of children at this particular grade level.

Operatons and Properties

C. Students have not mastered previous concepts upon which this concept is dependent.
E. This topic would not receive the instructional emphasis required for mastery.

Measurement

E. This topic would not receive the instructional emphasis required for mastery.

Geometry

E. This topic would not receive the instructional emphasis required for mastery.

TABLE 44

FREQUENCIES OF GRADE FOUR TEACHERS IN EXPERIENCE CATEGORIES CHOOSING FACTORS THAT INFLUENCE NON-MASTERY PERFORMANCE

```
GRADE: FOUR    STATEMENT:   8. The varied abilities of my students makes instruction difficu
*************

        YEARS TEACHING #  MOST LIKELY. . . . . . . . . . . LEAST LIKELY  #   ROW
          ZONE ONE     #   1     2     3     4     5     6     7     8   # TOTALS
        ######################################################################
             1         #   3     2     1     0     0     2     1     2   #   11
             2         #   3     0     0     1     0     0     0     0   #    4
             3         #   2     1     0     0     0     0     0     0   #    3
             4         #   1     1     0     0     1     0     0     0   #    3
             5         #   3     2     0     0     1     0     1     0   #    7
             6         #   1     0     2     0     0     1     0     0   #    4
             7         #   0     0     0     0     0     0     0     0   #    0
             8         #   0     0     0     0     1     0     0     0   #    1
             9         #   0     0     0     1     1     1     0     0   #    3
          >= 10        #   2     2     1     1     1     2     1     2   #   12
        ===============#=====================================================#=======
        COLUMN TOTALS  #  15     8     4     3     5     6     3     4   #   48
                    Pearson r =  0.214      r-squared = 0.046

GRADE: FOUR    STATEMENT:  11. Students fail to master objectives because of inadequate
*************                  learning skills (e.g., forgetting).

        YEARS TEACHING #  MOST LIKELY. . . . . . . . . . . LEAST LIKELY  #   ROW
          ZONE ONE     #   1     2     3     4     5     6     7     8   # TOTALS
        ######################################################################
             1         #   1     2     2     3     1     0     0     1   #   10
             2         #   1     1     0     2     0     0     0     0   #    4
             3         #   1     2     0     0     0     0     0     0   #    3
             4         #   1     0     1     1     0     0     0     0   #    3
             5         #   1     2     1     0     0     0     3     0   #    7
             6         #   1     1     1     0     0     0     0     1   #    4
             7         #   0     0     0     0     0     0     0     0   #    0
             8         #   0     1     0     0     0     0     0     0   #    1
             9         #   1     0     1     1     0     0     0     0   #    3
          >= 10        #   2     2     3     2     2     0     1     0   #   12
        ===============#=====================================================#=======
        COLUMN TOTALS  #   9    11     9     9     3     0     4     2   #   47
                    Pearson r = -0.005      r-squared = 0.000

GRADE: FOUR    STATEMENT:  10. Keeping track of failure ard successes and subsequent follow-up
*************                  is too difficult.

        YEARS TEACHING #  MOST LIKELY. . . . . . . . . . . LEAST LIKELY  #   ROW
          ZONE ONE     #   1     2     3     4     5     6     7     8   # TOTALS
        ######################################################################
             1         #   1     1     0     2     1     3     1     2   #   11
             2         #   1     1     0     0     0     0     0     2   #    4
             3         #   0     1     0     0     0     0     0     2   #    3
             4         #   1     0     0     0     1     0     1     0   #    3
             5         #   0     2     1     2     0     1     0     1   #    7
             6         #   0     0     1     1     1     0     0     1   #    4
             7         #   0     0     0     0     0     0     0     0   #    0
             8         #   0     0     0     0     0     0     1     0   #    1
             9         #   0     1     0     0     0     0     0     2   #    3
          >= 10        #   1     0     1     0     0     2     4     4   #   12
        ===============#=====================================================#=======
        COLUMN TOTALS  #   4     6     3     5     3     6     7    14   #   48
                    Pearson r =  0.205      r-squared = 0.042

GRADE: FOUR    STATEMENT:   6. The program objectives for my grade level are too difficult.
*************

        YEARS TEACHING #  MOST LIKELY. . . . . . . . . . . LEAST LIKELY  #   ROW
          ZONE ONE     #   1     2     3     4     5     6     7     8   # TOTALS
        ######################################################################
             1         #   0     0     1     1     1     0     4     3   #   10
             2         #   0     0     0     1     0     1     2     0   #    4
             3         #   0     0     1     0     1     0     1     0   #    3
             4         #   0     2     0     0     0     0     1     0   #    3
             5         #   0     0     1     3     1     0     2     0   #    7
             6         #   0     0     0     1     0     0     2     0   #    3
             7         #   0     0     0     0     0     0     0     0   #    0
             8         #   1     0     0     0     0     0     0     0   #    1
             9         #   1     0     0     0     0     1     1     0   #    3
          >= 10        #   2     1     3     0     2     0     0     4   #   12
        ===============#=====================================================#=======
        COLUMN TOTALS  #   4     3     6     6     5     2    13     7   #   46
                    Pearson r = -0.205      r-squared = 0.081
```

TABLE 45

FREQUENCIES OF GRADE FOUR TEACHERS IN EXPERIENCE CATEGORIES CHOOSING FACTORS THAT INFLUENCE GOOD MATHEMATICS PROGRAMS

GRADE: FOUR STATEMENT: 12. A instructional plan involving good teachable materials.

YEARS TEACHING ZONE ONE	MOST IMPORTANT. . . . . LEAST IMPORTANT							ROW TOTALS
	1	2	3	4	5	6	7	
1	7	2	2	0	0	0	0	11
2	3	0	0	0	1	0	0	4
3	1	1	1	0	0	0	0	3
4	0	1	0	1	0	0	0	2
5	1	0	3	2	0	0	1	7
6	2	0	1	0	0	1	0	4
7	0	0	0	0	0	0	0	0
8	0	1	0	0	0	0	0	1
9	1	1	1	0	0	0	0	3
>= 10	2	4	1	2	1	0	2	12
COLUMN TOTALS	17	10	9	5	2	1	3	47

Pearson r = 0.324 r-squared = 0.105

GRADE: FOUR STATEMENT: 13. Textbooks that students like and which cover the program objectives.

YEARS TEACHING ZONE ONE	MOST IMPORTANT. . . . . LEAST IMPORTANT							ROW TOTALS
	1	2	3	4	5	6	7	
1	4	4	1	1	0	0	0	10
2	2	1	0	1	0	0	0	4
3	1	1	0	1	0	0	0	3
4	1	1	0	0	0	0	0	2
5	3	0	0	1	2	0	1	7
6	0	1	1	0	1	0	1	4
7	0	0	0	0	0	0	0	0
8	0	0	1	0	0	0	0	1
9	0	2	1	0	0	0	0	3
>= 10	4	1	2	3	0	1	1	12
COLUMN TOTALS	15	11	6	7	3	1	3	46

Pearson r = 0.248 r-squared = 0.061

GRADE: FOUR STATEMENT: 16. A class room of children grouped so that their needs, abilit and interests are alike.

YEARS TEACHING ZONE ONE	MOST IMPORTANT. . . . . LEAST IMPORTANT							ROW TOTALS
	1	2	3	4	5	6	7	
1	2	0	0	1	2	3	3	11
2	2	0	0	0	1	1	0	4
3	0	1	0	0	0	1	1	3
4	0	0	0	1	0	0	2	3
5	2	1	0	1	1	1	1	7
6	1	1	0	0	0	0	2	4
7	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	1	1
9	0	0	0	1	1	0	1	3
>= 10	0	0	2	3	2	3	2	12
COLUMN TOTALS	7	3	2	7	7	9	13	48

Pearson r = 0.082 r-squared = 0.007

GRADE: FOUR STATEMENT: 17. The professional training of the teachier in our system.

YEARS TEACHING ZONE ONE	MOST IMPORTANT. . . . . LEAST IMPORTANT							ROW TOTALS
	1	2	3	4	5	6	7	
1	2	0	0	2	2	3	2	11
2	1	0	0	0	0	1	2	4
3	0	1	0	0	0	2	0	3
4	0	0	0	1	2	0	0	3
5	0	1	0	0	2	1	3	7
6	0	0	0	0	2	2	0	4
7	0	0	0	0	0	0	0	0
8	0	0	0	0	1	0	0	1
9	0	0	0	0	2	1	0	3
>= 10	2	2	2	0	2	1	3	12
COLUMN TOTALS	5	4	2	3	13	11	10	48

Pearson r = -0.108 r-squared = 0.012

```
GRADE: FOUR     STATEMENT:  19. Number
************

   YEARS TEACHING #    REASONS FOR LOW STRAND MARKS       #   ROW
      ZONE ONE    #    A     B     C     D     E     F  #  TOTALS
###################################################################
         1        #    0     4     5     0     1     0  #    10
         2        #    0     0     0     0     1     2  #     3
         3        #    0     0     1     0     1     0  #     2
         4        #    0     0     1     0     1     1  #     3
         5        #    1     1     2     0     1     2  #     7
         6        #    0     0     1     0     0     0  #     1
         7        #    0     0     0     0     0     0  #     0
         8        #    0     0     0     0     0     1  #     1
         9        #    1     0     0     1     1     0  #     3
       >= 10      #    0     2     1     0     1     5  #     9
------------------#---------------------------------------#--------
   COLUMN TOTALS  #    2     7    11     1     7    11  #    39
                  Eta-squared =  0.198
GRADE: FOUR     STATEMENT:  20. Operations and Properties
************

   YEARS TEACHING #    REASONS FOR LOW STRAND MARKS       #   ROW
      ZONE ONE    #    A     B     C     D     E     F  #  TOTALS
###################################################################
         1        #    1     2     3     0     3     1  #    10
         2        #    0     1     2     0     0     0  #     3
         3        #    0     0     2     0     1     0  #     3
         4        #    1     0     2     0     0     0  #     3
         5        #    2     0     4     0     1     0  #     7
         6        #    0     0     1     0     1     0  #     2
         7        #    0     0     0     0     0     0  #     0
         8        #    0     0     1     0     0     0  #     1
         9        #    0     0     0     0     2     0  #     2
       >= 10      #    3     2     2     0     2     1  #    10
------------------#---------------------------------------#--------
   COLUMN TOTALS  #    7     5    17     0    10     2  #    41
                  Eta-squared =  0.046
GRADE: FOUR     STATEMENT:  21. Measurement
************

   YEARS TEACHING #    REASONS FOR LOW STRAND MARKS       #   ROW
      ZONE ONE    #    A     B     C     D     E     F  #  TOTALS
###################################################################
         1        #    0     2     3     3     1     1  #    10
         2        #    0     0     0     1     1     1  #     3
         3        #    1     0     1     0     0     0  #     2
         4        #    0     0     2     0     1     0  #     3
         5        #    0     2     1     1     3     0  #     7
         6        #    0     0     0     1     1     0  #     2
         7        #    0     0     0     0     0     0  #     0
         8        #    0     1     0     0     0     0  #     1
         9        #    0     0     0     1     1     0  #     2
       >= 10      #    1     3     1     1     1     2  #     9
------------------#---------------------------------------#--------
   COLUMN TOTALS  #    2     8     8     8     9     4  #    39
                  Eta-squared =  0.081
```

```
GRADE: FOUR     STATEMENT:  22. Geometry
************

   YEARS TEACHING #    REASONS FOR LOW STRAND MARKS       #   ROW
      ZONE ONE    #    A     B     C     D     E     F  #  TOTALS
###################################################################
         1        #    0     4     2     1     3     0  #    10
         2        #    0     1     1     0     1     1  #     4
         3        #    0     2     0     0     1     0  #     3
         4        #    0     0     1     2     0     0  #     3
         5        #    0     1     0     2     2     2  #     7
         6        #    0     0     0     1     1     0  #     2
         7        #    0     0     0     0     0     0  #     0
         8        #    0     0     1     0     0     0  #     1
         9        #    0     0     0     0     2     0  #     2
       >= 10      #    0     2     1     2     1     3  #     9
------------------#---------------------------------------#--------
   COLUMN TOTALS  #    0    10     6     8    11     6  #    41
                  Eta-squared =  0.099
GRADE: FOUR     STATEMENT:  23. Graphing
************

   YEARS TEACHING #    REASONS FOR LOW STRAND MARKS       #   ROW
      ZONE ONE    #    A     B     C     D     E     F  #  TOTALS
###################################################################
         1        #    0     1     4     0     4     1  #    10
         2        #    0     1     0     1     2     0  #     4
         3        #    1     0     0     0     1     0  #     2
         4        #    0     0     0     2     0     1  #     3
         5        #    1     1     0     0     3     2  #     7
         6        #    0     0     0     1     1     0  #     2
         7        #    0     0     0     0     0     0  #     0
         8        #    0     1     0     0     0     0  #     1
         9        #    0     0     0     0     1     1  #     2
       >= 10      #    0     0     1     1     2     4  #     8
------------------#---------------------------------------#--------
   COLUMN TOTALS  #    2     4     5     5    14     9  #    39
                  Eta-squared =  0.168
```

TABLE 46

FREQUENCIES OF GRADE FOUR TEACHERS
IN EXPERIENCE CATEGORIES CHOOSING
REASONS FOR LOWEST MEANS BY STRAND

Graphing

E. This topic would not receive the instructional emphasis required for mastery.

Grade Five

The factors below were chosen by grade five teachers as representing the most likely and least likely influences for pupils not achieving within Category D (85-100 percent).

Most likely

5. Textbooks do not match the program objectives.
11. Students fail to master objectives because of inadequate learning skills (eg. forgetting).

Least likely

6. The program objectives for my grade level are too difficult.
10. Keeping track of failures and successes and subsequent follow-up is too difficult.

When thinking about the quality aspect of a mathematics program they suggest the points which follow:

Most important

12. An instructional plan involving good teachable materials.
15. A program geared to the ability levels of all children.

Least important

17. The professional training of teachers in our system.
18. The continous (inservice) education of teachers in

our system in mathematics.

The difficulties within the strands at the grade five level were attributed to the factors listed below.

Number

C. Students have not mastered previous concepts upon which this concept is dependent.

Operations and Properties

A. Students traditionally have difficulty with this topic.

Measurement

B. The topic is new. Understanding will grow with teacher familiarity.

Geometry

E. This topic would not receive the instructional emphasis required for mastery.

Graphing

E. This topic would not receive the instructional emphasis required for msatery.

Grade Six

According to the grade six teachers the most and least likely factors that caused the lack of achievement to the 85-100 percent level in their schools are:

Most likely

11. Students fail to master objectives because of inadequate learning skills (eg. forgetting).

5. Textbooks do not match the program objectives

TABLE 47

FREQUENCIES OF GRADE FIVE TEACHERS IN EXPERIENCE CATEGORIES CHOOSING FACTORS THAT INFLUENCE NON-MASTERY PERFORMANCE

```
GRADE: FIVE     STATEMENT:   5. Texbooks do not match the program objectives.
*************

     YEARS TEACHING #  MOST LIKELY. . . . . . . . . . . LEAST LIKELY  #   ROW
        ZONE ONE    #    1     2     3     4     5     6     7     8  #  TOTALS
     ##############################################################################
           1        #    1     1     1     0     0     1     0     0  #    4
           2        #    0     0     0     0     0     0     1     1  #    2
           3        #    1     0     0     1     1     1     0     0  #    4
           4        #    2     2     0     0     0     0     0     0  #    4
           5        #    0     0     1     0     0     1     0     0  #    2
           6        #    0     0     0     1     0     0     0     0  #    1
           7        #    0     0     0     0     0     0     0     0  #    0
           8        #    0     0     0     0     0     0     0     0  #    0
           9        #    0     0     0     0     0     0     0     0  #    0
         >= 10      #    3     2     2     0     0     0     0     1  #    8
     ==============================================================================
     COLUMN TOTALS  #    7     5     4     2     1     3     1     2  #   25
                    Pearson r = -0.229       r-squared = 0.053

GRADE: FIVE     STATEMENT:  11. Students fail to master objectives because of inadequate
*************                   learning skills (e.g., forgetting).

     YEARS TEACHING #  MOST LIKELY. . . . . . . . . . . LEAST LIKELY  #   ROW
        ZONE ONE    #    1     2     3     4     5     6     7     8  #  TOTALS
     ##############################################################################
           1        #    2     2     0     0     0     0     0     0  #    4
           2        #    0     1     1     0     0     0     0     0  #    2
           3        #    0     1     0     1     1     0     0     0  #    3
           4        #    0     0     1     1     1     0     0     1  #    4
           5        #    0     1     0     0     0     0     1     0  #    2
           6        #    0     1     0     0     0     0     0     0  #    1
           7        #    0     0     0     0     0     0     0     0  #    0
           8        #    0     0     0     0     0     0     0     0  #    0
           9        #    0     0     0     0     0     0     0     0  #    0
         >= 10      #    3     0     0     1     3     0     2     0  #    9
     ==============================================================================
     COLUMN TOTALS  #    5     6     2     3     5     0     3     1  #   25
                    Pearson r =  0.269       r-squared = 0.073

GRADE: FIVE     STATEMENT:   6. The program objectives for my grade level are too difficult.
*************

     YEARS TEACHING #  MOST LIKELY. . . . . . . . . . . LEAST LIKELY  #   ROW
        ZONE ONE    #    1     2     3     4     5     6     7     8  #  TOTALS
     ##############################################################################
           1        #    0     0     0     1     0     1     2     0  #    4
           2        #    0     0     0     0     0     1     0     1  #    2
           3        #    0     0     0     0     0     0     1     3  #    4
           4        #    0     0     1     0     0     2     1     0  #    4
           5        #    1     0     0     0     0     0     1     0  #    2
           6        #    0     0     0     0     1     0     0     0  #    1
           7        #    0     0     0     0     0     0     0     0  #    0
           8        #    0     0     0     0     0     0     0     0  #    0
           9        #    0     0     0     0     0     0     0     0  #    0
         >= 10      #    0     0     1     1     0     1     4     2  #    9
     ==============================================================================
     COLUMN TOTALS  #    1     0     2     2     1     5     9     6  #   26
                    Pearson r = -0.038       r-squared = 0.001

GRADE: FIVE     STATEMENT:  10. Keeping track of failure and successes and subsequent follow-up
*************                   is too difficult.

     YEARS TEACHING #  MOST LIKELY. . . . . . . . . . . LEAST LIKELY  #   ROW
        ZONE ONE    #    1     2     3     4     5     6     7     8  #  TOTALS
     ##############################################################################
           1        #    0     0     0     0     0     1     1     1  #    3
           2        #    0     0     1     0     0     0     1     0  #    2
           3        #    1     0     0     1     0     1     0     1  #    4
           4        #    0     0     0     0     0     1     2     1  #    4
           5        #    0     0     0     0     1     0     0     1  #    2
           6        #    0     0     0     0     0     0     0     1  #    1
           7        #    0     0     0     0     0     0     0     0  #    0
           8        #    0     0     0     0     0     0     0     0  #    0
           9        #    0     0     0     0     0     0     0     0  #    0
         >= 10      #    0     0     0     2     2     2     0     2  #    8
     ==============================================================================
     COLUMN TOTALS  #    1     0     1     3     3     5     4     7  #   24
                    Pearson r = -0.056       r-squared = 0.003
```

TABLE 48

FREQUENCIES OF GRADE FIVE TEACHERS IN EXPERIENCE CATEGORIES CHOOSING FACTORS THAT INFLUENCE GOOD MATHEMATICS PROGRAMS

```
GRADE: FIVE    STATEMENT:  12. A instructional plan involving good teachable materials.
************

        YEARS TEACHING #  MOST IMPORTANT. . . . . LEAST IMPORTANT  #   ROW
          ZONE ONE     #   1     2     3     4     5     6     7   #  TOTALS
        ################################################################
             1         #   1     0     1     3     0     0     0   #    5
             2         #   0     0     1     1     0     0     0   #    2
             3         #   3     0     0     1     0     0     0   #    4
             4         #   0     2     0     2     0     0     0   #    4
             5         #   1     0     1     0     0     0     0   #    2
             6         #   0     0     1     0     0     0     0   #    1
             7         #   0     0     0     0     0     0     0   #    0
             8         #   0     0     0     0     0     0     0   #    0
             9         #   0     0     0     0     0     0     0   #    0
           >= 10       #   4     2     0     2     0     0     1   #    9
        ===============#===========================================#========
        COLUMN TOTALS  #   9     4     4     9     0     0     1   #   27
                        Pearson r = -0.098     r-squared = 0.010

GRADE: FIVE    STATEMENT:  15. A program that is geared to the ability levels of all children.
************

        YEARS TEACHING #  MOST IMPORTANT. . . . . LEAST IMPORTANT  #   ROW
          ZONE ONE     #   1     2     3     4     5     6     7   #  TOTALS
        ################################################################
             1         #   4     0     0     0     0     1     0   #    5
             2         #   0     2     0     0     0     0     0   #    2
             3         #   0     0     0     0     1     1     2   #    4
             4         #   3     0     1     0     0     0     0   #    4
             5         #   1     0     0     0     0     1     0   #    2
             6         #   0     1     0     0     0     0     0   #    1
             7         #   0     0     0     0     0     0     0   #    0
             8         #   0     0     0     0     0     0     0   #    0
             9         #   0     0     0     0     0     0     0   #    0
           >= 10       #   2     0     1     2     2     1     1   #    9
        ===============#===========================================#========
        COLUMN TOTALS  #  10     3     2     2     3     4     3   #   27
                        Pearson r =  0.216     r-squared = 0.048

GRADE: FIVE    STATEMENT:  17. The professional training of the teachier in our system.
************

        YEARS TEACHING #  MOST IMPORTANT. . . . . LEAST IMPORTANT  #   ROW
          ZONE ONE     #   1     2     3     4     5     6     7   #  TOTALS
        ################################################################
             1         #   1     0     1     1     0     0     2   #    5
             2         #   0     0     0     0     1     0     1   #    2
             3         #   0     1     0     0     1     0     2   #    4
             4         #   0     0     0     0     0     2     2   #    4
             5         #   0     0     0     1     1     0     0   #    2
             6         #   0     0     0     0     0     0     1   #    1
             7         #   0     0     0     0     0     0     0   #    0
             8         #   0     0     0     0     0     0     0   #    0
             9         #   0     0     0     0     0     0     0   #    0
           >= 10       #   0     0     1     1     2     2     3   #    9
        ===============#===========================================#========
        COLUMN TOTALS  #   1     1     2     3     5     4    11   #   27
                        Pearson r =  0.131     r-squared = 0.017

GRADE: FIVE    STATEMENT:  18. The continuous (inservice) education of teachers in our system
************                   in mathematics.

        YEARS TEACHING #  MOST IMPORTANT. . . . . LEAST IMPORTANT  #   ROW
          ZONE ONE     #   1     2     3     4     5     6     7   #  TOTALS
        ################################################################
             1         #   1     2     0     0     1     1     0   #    5
             2         #   0     0     0     0     1     1     0   #    2
             3         #   0     1     1     1     0     0     1   #    4
             4         #   0     0     0     1     1     1     1   #    4
             5         #   0     0     1     0     0     1     0   #    2
             6         #   0     0     0     0     0     1     0   #    1
             7         #   0     0     0     0     0     0     0   #    0
             8         #   0     0     0     0     0     0     0   #    0
             9         #   0     0     0     0     0     0     0   #    0
           >= 10       #   1     0     1     0     1     5     1   #    9
        ===============#===========================================#========
        COLUMN TOTALS  #   2     3     3     2     4    10     3   #   27
                        Pearson r =  0.269     r-squared = 0.072
```

```
GRADE: FIVE    STATEMENT:  19. Number
*************

     YEARS TEACHING #     REASONS FOR LOW STRAND MARKS       #    ROW
        ZONE ONE    #   A      B      C      D      E      F   #  TOTALS
     ################################################################
            1       #   1      1      3      0      0      0   #    5
            2       #   0      0      1      0      0      1   #    2
            3       #   1      0      1      1      1      0   #    4
            4       #   0      0      3      0      1      0   #    4
            5       #   0      0      1      0      0      1   #    2
            6       #   0      0      1      0      0      0   #    1
            7       #   0      0      0      0      0      0   #    0
            8       #   0      0      0      0      0      0   #    0
            9       #   0      0      0      0      0      0   #    0
         >= 10      #   0      1      7      0      0      1   #    9
     ---------------#------------------------------------------#--------
     COLUMN TOTALS  #   2      2     17      1      2      3   #   27
                    Eta-squared =  0.120
```

```
GRADE: FIVE    STATEMENT:  20. Operations and Properties
*************

     YEARS TEACHING #     REASONS FOR LOW STRAND MARKS       #    ROW
        ZONE ONE    #   A      B      C      D      E      F   #  TOTALS
     ################################################################
            1       #   0      0      3      0      1      0   #    4
            2       #   1      0      1      0      0      0   #    2
            3       #   3      0      0      1      0      0   #    4
            4       #   1      0      1      0      1      0   #    3
            5       #   1      0      1      0      0      0   #    2
            6       #   1      0      0      0      0      0   #    1
            7       #   0      0      0      0      0      0   #    0
            8       #   0      0      0      0      0      0   #    0
            9       #   0      0      0      0      0      0   #    0
         >= 10      #   3      0      4      1      0      1   #    9
     ---------------#------------------------------------------#--------
     COLUMN TOTALS  #  10      0     10      2      2      1   #   25
                    Eta-squared =  0.126
```

```
GRADE: FIVE    STATEMENT:  21. Measurement
*************

     YEARS TEACHING #     REASONS FOR LOW STRAND MARKS       #    ROW
        ZONE ONE    #   A      B      C      D      E      F   #  TOTALS
     ################################################################
            1       #   0      1      2      1      1      0   #    5
            2       #   0      0      1      1      0      0   #    2
            3       #   0      3      0      1      0      0   #    4
            4       #   1      2      0      1      0      0   #    4
            5       #   0      0      1      1      0      0   #    2
            6       #   0      1      0      0      0      0   #    1
            7       #   0      0      0      0      0      0   #    0
            8       #   0      0      0      0      0      0   #    0
            9       #   0      0      0      0      0      0   #    0
         >= 10      #   0      4      3      1      1      0   #    9
     ---------------#------------------------------------------#--------
     COLUMN TOTALS  #   1     11      7      6      2      0   #   27
                    Eta-squared =  0.038
```

```
GRADE: FIVE    STATEMENT:  22. Geometry
*************

     YEARS TEACHING #     REASONS FOR LOW STRAND MARKS       #    ROW
        ZONE ONE    #   A      B      C      D      E      F   #  TOTALS
     ################################################################
            1       #   1      1      1      0      2      0   #    5
            2       #   0      0      0      0      2      0   #    2
            3       #   1      0      1      0      2      0   #    4
            4       #   0      0      0      0      3      0   #    3
            5       #   0      0      0      1      0      1   #    2
            6       #   0      0      0      0      1      0   #    1
            7       #   0      0      0      0      0      0   #    0
            8       #   0      0      0      0      0      0   #    0
            9       #   0      0      0      0      0      0   #    0
         >= 10      #   1      0      0      2      5      1   #    9
     ---------------#------------------------------------------#--------
     COLUMN TOTALS  #   3      1      2      3     15      2   #   26
                    Eta-squared =  0.232
```

```
GRADE: FIVE    STATEMENT:  23. Graphing
*************

     YEARS TEACHING #     REASONS FOR LOW STRAND MARKS       #    ROW
        ZONE ONE    #   A      B      C      D      E      F   #  TOTALS
     ################################################################
            1       #   1      1      0      0      3      0   #    5
            2       #   0      0      0      0      1      1   #    2
            3       #   0      0      0      0      4      0   #    4
            4       #   0      0      0      1      2      0   #    3
            5       #   0      0      1      0      0      1   #    2
            6       #   0      0      0      0      1      0   #    1
            7       #   0      0      0      0      0      0   #    0
            8       #   0      0      0      0      0      0   #    0
            9       #   0      0      0      0      0      0   #    0
         >= 10      #   0      1      2      3      2      1   #    9
     ---------------#------------------------------------------#--------
     COLUMN TOTALS  #   1      2      3      4     13      3   #   26
                    Eta-squared =  0.330
```

TABLE 49

FREQUENCIES OF GRADE FIVE TEACHERS
IN EXPERIENCE CATEGORIES CHOOSING
REASONS FOR LOWEST MEANS BY STRAND

Least likely

10. Keeping track of failures and successes and subsequent follow-up is too difficult.
6. The program objectives for my grade level are too difficult.

The grade six teachers thought the following to be the factors of most and least importance in the conducting of a good mathematics program:

Most important

12. An instructional plan involving teachable materials.
15. A program that is geared to the ability levels of all children.

Least important

17. The professional training of teachers in our systems.
16. A classroom of children grouped so that their needs, abilities and interests are alike.

The grade six teachers regarded the following influence to be the primary cause of the low achievement scores within each of the strands.

Number

C. Students have not mastered previous concepts upon which this concept is dependent.

Operations and Properties

C. Students have not mastered previous concepts upon which this concept is dependent.

Measurement

TABLE 50

FREQUENCY OF GRADE SIX TEACHERS IN EXPERIENCE CATEGORIES CHOOSING FACTORS THAT INFLUENCE NON-MASTERY PERFORMANCE

GRADE: SIX STATEMENT: 11. Students fail to master objectives because of inadequate learning skills (e.g., forgetting).

YEARS TEACHING	MOST LIKELY. . .						LEAST LIKELY		ROW
ZONE ONE	1	2	3	4	5	6	7	8	TOTALS
1	2	0	0	1	1	0	0	1	5
2	3	0	1	1	0	0	0	0	5
3	1	2	0	0	0	0	0	0	3
4	0	1	0	1	0	0	0	0	2
5	1	0	0	0	1	1	0	0	3
6	0	0	0	0	0	0	0	0	0
7	1	0	0	0	0	0	0	0	1
8	0	0	1	1	0	0	0	0	2
9	0	1	1	0	0	0	0	0	2
>= 10	3	2	1	4	1	0	0	0	11
COLUMN TOTALS	11	6	4	8	3	1	0	1	34

Pearson r = -0.014 r-squared = 0.000

GRADE: SIX STATEMENT: 5. Texbooks do not match the program objectives.

YEARS TEACHING	MOST LIKELY. . .						LEAST LIKELY		ROW
ZONE ONE	1	2	3	4	5	6	7	8	TOTALS
1	0	2	1	2	0	0	0	0	5
2	1	1	1	1	0	0	1	0	5
3	0	0	1	0	1	0	0	1	3
4	1	0	0	1	0	0	0	0	2
5	1	1	0	0	0	0	1	0	3
6	0	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	1	0	1
8	1	1	0	0	0	0	0	0	2
9	0	1	0	0	0	0	0	1	2
>= 10	3	3	0	3	0	3	0	0	12
COLUMN TOTALS	7	9	3	7	1	3	3	2	35

Pearson r = -0.018 r-squared = 0.000

GRADE: SIX STATEMENT: 10. Keeping track of failure and successes and subsequent follow-up is too difficult.

YEARS TEACHING	MOST LIKELY. . .						LEAST LIKELY		ROW
ZONE ONE	1	2	3	4	5	6	7	8	TOTALS
1	0	0	0	0	2	0	3	0	5
2	0	0	1	0	1	0	0	3	5
3	0	0	1	0	1	0	1	0	3
4	0	0	0	0	0	1	0	1	2
5	0	0	0	0	0	1	0	2	3
6	0	0	0	0	0	0	0	0	0
7	0	1	0	0	0	0	0	0	1
8	0	0	0	0	0	1	1	0	2
9	0	0	0	0	1	1	0	0	2
>= 10	0	1	0	0	3	3	2	3	12
COLUMN TOTALS	0	2	2	0	8	7	7	9	35

Pearson r = -0.059 r-squared = 0.004

GRADE: SIX STATEMENT: 6. The program objectives for my grade level are too difficult.

YEARS TEACHING	MOST LIKELY. . .						LEAST LIKELY		ROW
ZONE ONE	1	2	3	4	5	6	7	8	TOTALS
1	0	0	0	1	1	0	2	1	5
2	0	0	1	1	1	1	1	0	5
3	0	0	1	0	0	1	0	1	3
4	0	0	0	0	0	0	0	2	2
5	0	0	0	1	0	1	1	0	3
6	0	0	0	0	0	0	0	0	0
7	0	0	0	0	0	1	0	0	1
8	0	0	0	0	0	1	1	0	2
9	0	0	1	0	0	0	0	1	2
>= 10	0	1	1	0	2	2	5	1	12
COLUMN TOTALS	0	1	4	3	4	7	10	6	35

Pearson r = 0.008 r-squared = 0.000

TABLE 51

FREQUENCIES OF GRADE SIX TEACHERS IN EXPERIENCE CATEGORIES CHOOSING FACTORS THAT INFLUENCE GOOD MATHEMATICS PROGRAMS

```
GRADE: SIX     STATEMENT:  12. A instructional plan involving good teachable materials.
************

        YEARS TEACHING #  MOST IMPORTANT. . . . . LEAST IMPORTANT  #   ROW
           ZONE ONE    #   1     2     3     4     5     6     7   #  TOTALS
        ############################################################################
            1          #   4     0     0     0     1     0     0   #    5
            2          #   4     0     0     1     0     0     0   #    5
            3          #   0     0     0     2     1     0     0   #    3
            4          #   0     0     1     0     0     1     0   #    2
            5          #   1     0     0     1     1     0     0   #    3
            6          #   0     0     0     0     0     0     0   #    0
            7          #   0     0     0     0     1     0     0   #    1
            8          #   0     1     0     0     0     0     0   #    1
            9          #   1     1     0     0     0     0     0   #    2
          >= 10        #   5     1     1     4     0     1     0   #   12
        ===============#===========================================#========
        COLUMN TOTALS  #  15     3     2     8     4     2     0   #   34
                       Pearson r =  0.059     r-squared = 0.003

GRADE: SIX     STATEMENT:  15. A program that is geared to the ability levels of all children.
************

        YEARS TEACHING #  MOST IMPORTANT. . . . . LEAST IMPORTANT  #   ROW
           ZONE ONE    #   1     2     3     4     5     6     7   #  TOTALS
        ############################################################################
            1          #   0     1     2     0     0     1     1   #    5
            2          #   0     3     1     1     0     0     0   #    5
            3          #   1     1     0     0     0     0     1   #    3
            4          #   0     1     0     1     0     0     0   #    2
            5          #   1     2     0     0     0     0     0   #    3
            6          #   0     0     0     0     0     0     0   #    0
            7          #   1     0     0     0     0     0     0   #    1
            8          #   0     0     0     2     0     0     0   #    2
            9          #   0     0     1     0     1     0     0   #    2
          >= 10        #   2     2     2     1     1     3     0   #   11
        ===============#===========================================#========
        COLUMN TOTALS  #   5    10     6     5     2     4     2   #   34
                       Pearson r =  0.057     r-squared = 0.003

GRADE: SIX     STATEMENT:  17. The professional training of the teachier in our system.
************

        YEARS TEACHING #  MOST IMPORTANT. . . . . LEAST IMPORTANT  #   ROW
           ZONE ONE    #   1     2     3     4     5     6     7   #  TOTALS
        ############################################################################
            1          #   1     0     0     2     1     1     0   #    5
            2          #   1     0     0     0     2     0     2   #    5
            3          #   0     0     1     0     1     1     0   #    3
            4          #   1     0     0     0     0     0     1   #    2
            5          #   0     0     0     0     0     1     2   #    3
            6          #   0     0     0     0     0     0     0   #    0
            7          #   0     0     0     0     0     0     1   #    1
            8          #   0     0     0     1     0     0     1   #    2
            9          #   0     0     0     1     0     0     1   #    2
          >= 10        #   1     2     2     0     3     3     1   #   12
        ===============#===========================================#========
        COLUMN TOTALS  #   4     2     3     4     7     6     9   #   35
                       Pearson r = -0.010     r-squared = 0.000

GRADE: SIX     STATEMENT:  16. A class room of children grouped so that their needs, abilities
************                   and interests are alike.

        YEARS TEACHING #  MOST IMPORTANT. . . . . LEAST IMPORTANT  #   ROW
           ZONE ONE    #   1     2     3     4     5     6     7   #  TOTALS
        ############################################################################
            1          #   0     0     0     0     1     2     2   #    5
            2          #   0     0     0     1     1     2     1   #    5
            3          #   2     1     0     0     0     0     0   #    3
            4          #   1     0     0     0     0     0     1   #    2
            5          #   0     0     1     1     0     0     1   #    3
            6          #   0     0     0     0     0     0     0   #    0
            7          #   0     0     0     1     0     0     0   #    1
            8          #   0     0     0     1     0     1     0   #    2
            9          #   0     0     0     1     0     1     0   #    2
          >= 10        #   0     1     1     2     4     0     4   #   12
        ===============#===========================================#========
        COLUMN TOTALS  #   3     2     2     7     6     6     9   #   35
                       Pearson r = -0.005     r-squared = 0.000
```

```
GRADE: SIX      STATEMENT:  19. Number
*************

        YEARS TEACHING *    REASONS FOR LOW STRAND MARKS     *   ROW
          ZONE ONE     *   A     B     C     D     E     F   *  TOTALS
        ***********************************************************
              1        *   3     1     1     0     0     0   *   5
              2        *   0     1     2     0     0     0   *   3
              3        *   0     0     1     0     0     0   *   1
              4        *   1     0     1     0     0     0   *   2
              5        *   1     0     2     0     0     0   *   3
              6        *   0     0     0     0     0     0   *   0
              7        *   1     0     0     0     0     0   *   1
              8        *   1     0     1     0     0     0   *   2
              9        *   0     0     1     0     1     0   *   2
           >= 10       *   2     1     6     0     2     0   *  11
        ---------------*-------------------------------------*--------
        COLUMN TOTALS  *   9     3    15     0     3     0   *  30
                       Eta-squared =  0.146
GRADE: SIX      STATEMENT:  20. Operations and Properties
*************

        YEARS TEACHING *    REASONS FOR LOW STRAND MARKS     *   ROW
          ZONE ONE     *   A     B     C     D     E     F   *  TOTALS
        ***********************************************************
              1        *   1     0     3     0     0     1   *   5
              2        *   0     0     2     0     1     1   *   4
              3        *   0     0     1     0     1     0   *   2
              4        *   1     0     1     0     0     0   *   2
              5        *   1     0     1     0     0     0   *   2
              6        *   0     0     0     0     0     0   *   0
              7        *   0     0     1     0     0     0   *   1
              8        *   1     0     1     0     0     0   *   2
              9        *   1     0     1     0     0     0   *   2
           >= 10       *   3     2     4     0     2     0   *  11
        ---------------*-------------------------------------*--------
        COLUMN TOTALS  *   8     2    15     0     4     2   *  31
                       Eta-squared =  0.205
GRADE: SIX      STATEMENT:  21. Measurement
*************

        YEARS TEACHING *    REASONS FOR LOW STRAND MARKS     *   ROW
          ZONE ONE     *   A     B     C     D     E     F   *  TOTALS
        ***********************************************************
              1        *   0     0     1     1     3     0   *   5
              2        *   1     1     0     1     1     0   *   4
              3        *   0     1     0     0     0     0   *   1
              4        *   0     1     0     0     1     0   *   2
              5        *   0     1     1     0     0     0   *   2
              6        *   0     0     0     0     0     0   *   0
              7        *   0     0     1     0     0     0   *   1
              8        *   0     1     0     1     0     0   *   2
              9        *   0     0     0     0     2     0   *   2
           >= 10       *   0     3     3     2     2     1   *  11
        ---------------*-------------------------------------*--------
        COLUMN TOTALS  *   1     8     6     5     9     1   *  30
                       Eta-squared =  0.115
```

```
GRADE: SIX      STATEMENT:  22. Geometry
*************

        YEARS TEACHING *    REASONS FOR LOW STRAND MARKS     *   ROW
          ZONE ONE     *   A     B     C     D     E     F   *  TOTALS
        ***********************************************************
              1        *   0     1     1     0     3     0   *   5
              2        *   2     1     0     0     1     0   *   4
              3        *   0     0     1     0     0     0   *   1
              4        *   0     0     0     0     2     0   *   2
              5        *   0     0     0     0     2     0   *   2
              6        *   0     0     0     0     0     0   *   0
              7        *   0     1     0     0     0     0   *   1
              8        *   0     0     0     1     1     0   *   2
              9        *   0     1     0     0     1     0   *   2
           >= 10       *   2     2     2     1     4     1   *  12
        ---------------*-------------------------------------*--------
        COLUMN TOTALS  *   4     6     4     2    14     1   *  31
                       Eta-squared =  0.080
GRADE: SIX      STATEMENT:  23. Graphing
*************

        YEARS TEACHING *    REASONS FOR LOW STRAND MARKS     *   ROW
          ZONE ONE     *   A     B     C     D     E     F   *  TOTALS
        ***********************************************************
              1        *   0     0     1     1     3     0   *   5
              2        *   0     1     1     2     1     0   *   5
              3        *   0     0     1     0     0     0   *   1
              4        *   0     0     0     1     1     0   *   2
              5        *   0     0     1     0     1     0   *   2
              6        *   0     0     0     0     0     0   *   0
              7        *   1     0     0     0     0     0   *   1
              8        *   0     0     0     0     1     1   *   2
              9        *   0     1     0     0     0     0   *   1
           >= 10       *   1     3     2     2     2     1   *  11
        ---------------*-------------------------------------*--------
        COLUMN TOTALS  *   2     5     6     6     9     2   *  30
                       Eta-squared =  0.198
```

TABLE 52

FREQUENCIES OF GRADE SIX TEACHERS
IN EXPERIENCE CATEGORIES CHOOSING
REASONS FOR LOWEST MEANS BY STRAND

E. This topic would not receive the instructional emphasis required for mastery.

B. The topic is new understanding will grow with teacher familiarity.

Geometry

E. This topic would not receive the instructional emphasis required for mastery.

Graphing

E. This topic would not receive the instructional emphasis required for mastery.

A summary and discussion of the questionnaire findings will be included in Chapter XI and utilized in the conclusions of the study.

I. THE ACHIEVEMENT PROFILES

One of the stated purposes of this investigation was to provide teachers and school supervisors with student achievement results. This was made possible with the design of a computer program which reported the test performances of individual students, schools and school jurisdictions in relation to the specified objectives of the Alberta Program.

Computer printouts for each of the above were sent out to the school districts offices for distribution. This was completed by the researcher in October of 1978 and in July of 1979.

In addition to the individual student and school print-outs, the supervisors were provided additional data in the form of zone and out of zone, male-female and early-late starter comparisons (Appendix J).

A representative sample of fifteen teachers, five principals and five central office supervisors were interviewed concerning their utilization of the materials provided. The interview questioning of these individual had to consider the different procedures that were used for the two years.

The 1978 student print-outs were such that each profile had to be matched with a Student Analysis Form (Appendix F). This was accomplished by a process of matching numbers. Since the forms received from the schools had to be key punched and the analysis program written, the data packages were not sent out to the division offices until October of

1978.

An optically scanned form (Appendix G) designed for the 1979 analysis enabled a July shipment of the information to the jurisdictions. These forms had student names printed directly on the profiles so that no matching of forms was required.

The questions asked during the interviews were as follow: "What use, if any, were you able to make of the print-out information you received?" "What were the main strengths and weaknesses of the profiles?" "What added use do you expect to make of the 1979 forms which will include each student's name and also be available for school opening?"

J. THE USE OF THE PRINTOUTS

By teachers

The general conclusion from the teacher interviews was that the computer profiles were not being used as intended. Originally the print-outs were to be of diagnostic value in terms of indicating individual pupil and class errors. Follow-up teaching could then become more purposeful. Teachers on the other hand appear to be more interested in the comparative use of the materials. They were interested in how their class compares with others from within their system and throughout the Zone.

Although the teachers made little diagnostic use of the forms with individual children they did look at the composite achievement of their students and considered the problem areas as possible reflections of their instructional programs.

The teachers for the most part liked the tests but disagreed with the weighting alloted to the various items. They felt that the transferring of marks to the computer forms and Analysis sheets required excessive time. They liked the idea of having the pupil names on the printouts and thought that better use would be made of these forms.

Teachers also believed that the computer profiles would be utilized to a greater extent if they were available during the year and not after the pupils had moved on to the next grade.

By Principals

The reactions of principals to the computer print-outs were much like those of the teachers'. They too were intent on knowing how their schools compared to others. One principal, for example, had drawn a bar graph that showed the performances of his school as compared to the others within his systems and with those of the zone.

Few examples of instructional leadership were noted in terms of helping teachers make maximum use of the print-outs at the pupil level, even though discussion of the results was encouraged in most cases.

A majority of the principals were attempting to incorporate the student profiles within the cumulative record files. One school however had not received the 1978

Student Analysis Forms from the Division Office so it was impossible for him to even identify individual pupils.

A few of the principals and teachers had expressed concerns about the possible use of test information for implicating their competence. This again was a reflection of the emphasis given to comparing test results.

Central Office Supervisors

Use of the profile sheets at the jurisdiction level was as varied as at the school level. The political attitude of "how do we stand?", was also in evidence with the supervisors, although there was generally a high degree of interest in improving student performance.

One supervisor held school meetings concerning the test results in an attempt to generate solutions to perceived instructionally weak areas. Another however had forgot about the Student Analysis Form match-up and they remained in his office.

All supervisors expressed an interest for follow up work in their schools relative to improving the mathematics programs being offered their children. They also gave support to the concept of student assessment within their schools.

CHAPTER XI

SUMMARY, INTEGRATION, IMPLICATIONS AND RECOMMENDATIONS

A. SUMMARY OF THE STUDY

This study, involving a testing program in Zone One of the Province of Alberta, was first of all for purposes of assessing student understanding of the mathematics content as outlined in the Program of Studies for Elementary Schools (1978). Over 12 000 students were involved in the project which was conducted during 1978 and 1979. The information collected from these students during these two testing years was also to be used for diagnostic purposes as a service to teachers, and to school and central office supervisors. To enact this phase, computer profiles were provided to each of the schools and central offices in the Zone.

Another purpose of the study was to use the assessment data as a basis for discussing various implications for the mathematics curriculum.

Here it became obvious that at least two major curriculum facets were being implicated. For example, what aspects of low student achievement could be attributed to the content, organization and the premises upon which the curriculum development took place? Secondly, how much of the blame could be placed on the inadequacies of the procedures used for implementating the curriculum? It was not the intent of this study to establish the exact origin of the weakness within the curriculum however. Indeed it may be impossible to consider the development and the implementation of a curriculum along with the assessment of students, at least within the context of the same evaluation.

The Instruments

The test instruments utilized in this study were designed specifically for assessing the achievement of Zone One students in relation to the objectives of the 1977 Elementary Mathematics program. As such they were criterion referenced to the specified content by teachers, supervisors and the researcher who had all been associated with either or both the development and implementation of the new program. The grade one to six tests had been piloted and validated during the year prior to the June 1978 test administration.

Findings

The findings of the study were reported within the context of six major hypothesis which are contained in the previous seven Chapters of this document.

Hypothesis One

Hypothesis one stated that eighty percent of the students in Zone One would not achieve to a criterion level of 85 percent or better in 1978 and 1979 on each of the objectives in the Number, Operations and Properties, Measurement, Geometry, and Graphing strands in grades one to six.

This null hypothesis held for a majority of the objectives. Achievement in the Zone was such that the number of objectives for which eighty percent proportions were recorded decreased with the grades. Grade one had six proportions at the 85-100 percent level, grade two had four, and grade three had two. Only one such proportion was found throughout the whole Division II level.

Hypothesis Two

This hypothesis stated that there would be no significant difference in the percentage of students achieving within the 85-100 percent category between 1978 and 1979 on each of the objectives in the five strands for grades one to six.

The null hypothesis was not accepted for the majority of objectives in grades one to six. Significantly higher proportions of students in the Zone did reach the 85-100 percent achievement category for 1979. In Division II where there was more room for improvement, more students seemed to improve. For example, of the 79 objectives at the primary level, 34 had significantly more students in the higher category for 1979. Of the 95 objectives in Division II, 69 had significantly higher proportions of students achieving in the 85-100 percent range.

Hypothesis Three (Early-late starters)

Early starters were those students who commenced grade one younger than 6.0 years of age as of September 5. Late starters were older than 6.0 years as of the same date. For purposes of identifying the early and late starters in grades two through six, one year was added to a child's birth date for each subsequent grade in school. Hypothesis three said that there would be no significant differences between the early and late starters within each strand for grades one to six.

There were few or no achievement differences between students who started school younger or older at the primary level. There were hints of a difference favoring the grade three late starters but the differences were not significant. However beginning at grade four the late starters significantly outperformed their younger starting counterparts in most strands of the program.

Hypothesis Four (Male and Female)

The only area where one sex classification consistently outperformed the other was in the Operations and Properties strand. Here female students did better at all six grade levels. Not only do they do significantly better on the overall strand but also for most of the individual concepts and skills. From responses to the knowledge items it appears that girls have committed more mathematics learning to memory. The one concept area of the strand in which sex difference did not exist was for problem solving. Here both boys and girls had equally low performances.

Hypothesis Five (North and South Zone)

Schools north of and including the Peace River School Division were designated as North Zone One. The jurisdictions within this region included North Peace Separate, Fort Vermilion and the Northland School Divisions. All school systems south of the Peace River District boundary were identified as South Zone One.

The Northland School Division students were tested only at the grades two, four and five levels and their lower achievement scores appeared to have an impact on the subgroup comparisons in which they were involved. With Northland separated out as for grades one, three and six, there were few differences between the North and South Zone School Districts. But when the North was included at grades two, four and five differences favored the South Zone.

It is important to recognize again however that there are many factors that would influence achievement in the Northland system. The majority of children entering grade one do not speak English as a first language. The actual time that pupils spend on the individual content objectives because of attendance problems or supervisory adjustments to the Alberta program likely have an effect. Teacher mobility and the sociological-environmental conditions may also contribute to the lower performances.

Hypothesis Six (Public and Separate Schools)

Public students attended schools that are operated by publicly designated boards. Separate school pupils attend those institutions that are designated as Roman Catholic by faith.

Once again the Northland School Division as a Public system appears to influence the achievement picture. Public and Separate school differences were not significant in grades one, three and six where the system in question was not involved. Most of the achievement differences favoring the Separate school pupils were in grades two, and five (10/13). Also most of the Public student advantages were in grades one, three and six. Another interesting comparison was between the testing years. Of the thirteen statistically higher achievement ratings in favor of Separate systems, all were in 1979. Fifteen of the sixteen achievement cells that favored the public schools were in the 1978 testing year.

B. THE QUESTIONNAIRE

Part I

According to the Zone One teachers the pupils within their respective school districts failed in their attempts to reach the highest achievement category (85-100 percent) for two equally popular reasons. They suggest that the problems arise because the textbooks that are currently authorized do not match the program objectives. Teachers also say that pupils have inadequate learning skills to enable them to master the program. In other words they feel that the difficulties lie with the pupil and the materials from which they are required to teach.

The factors that teachers thought were least likely to be responsible for the low student proportions in Category D were varied. Grades one and two teachers said that neither the program nor the test difficulty would be at fault. Grade three teachers chose the sequencing of content in the textbook and the keeping track of students performance and follow-up as the least likely factors. Division II teachers collectively agreed that neither the problems associated with keeping track of students performance nor the difficulty of the program should be responsible for the lack of achievement within the 85-100 percent level.

Part II

The two most popular factors that teachers of grades one to six thought would be at work in any good mathematics program were: first, an instructional plan that would involve good teachable materials, and; secondly, a program that could be geared to the ability level of all children.

They considered that grouping children for need, ability or interest purposes would be of little importance to an effective program. Teachers chose the professional training of instructors as an equally non-important factor.

Part III

This aspect of the questionnaire centered on what teachers thought to be the main causes for the lowest achievement scores within each of the strands. They were to respond in terms of each strand separately but for only one grade which they taught.

The number objectives related to place value had consistently lower scores on the 1978 tests. Teachers reported that the main reason for students failure was because they had not mastered the concepts upon which the concept in question was dependent.

Problem solving was the main weakness in the Operations and Properties strand and the most common reason the teachers cited as the primary cause was the same as for place value; that students had not mastered the previous concepts in the heirarchy.

Almost without question the most popular response with regard to the low achievement performances in the Measurement, Geometry, and the Graphing strands was that the topics would not receive the instructional emphasis required for mastery.

Teachers appear to be saying that the Number, and the Operations and Properties strands are to be considered the most important and that the lack of pupil learning within these strands is due primarily to pupil inadequacies.

C. INTEGRATION OF THE STUDY FINDINGS

The intent of this section of the report is to attempt to draw together the various segments into a more comprehensible whole. Ths integration should enable a better base upon which to make recommendations for program change or future research.

The Zone One Tests

Although teachers in the zone did not blame the test instruments for any particular failures which their students experienced, the difficulty level of the Division II items still may be influencing the lower achievement figures reported there.

For the most part the items appear to have been well referenced to objectives in the program of studies. However when compared to some of the instruments used in assessment (British Columbia and Alberta) and standardized testing (Canadian Test of Basic Skills), the Zone One items seem to be more demanding. Multiple choice items were all but non-existent and the many complicated completion type items, particularly at the division II level, were more open to computational error.

Also the test instruments were to be diagnostic in nature, however the clustering of the individual items for analysis of achievement by objective decreased the diagnostic value of the tests. Rather than being able to pinpoint a specific weakness such as the students' ability to identify the zero (0) as a place holder, the deficiency could only be regarded as a lack of place value or operational understanding.

Regardless of any particular weakness which may be directed at the instruments used in this study, the questionnaire data does support the validity of the tests upon which this study was based. According to the teachers the Zone One instruments were valid for the purposes of assessing student understanding and for evaluating the elementary mathematics program.

Student Achievement

There is good evidence to suggest that children come well equipped to handle the entry year of the elementary mathematics program. The results indicate that grade one students do experience success. One may even extend this assessment to many areas of the grades two and three program as well. However pupil achievement in mathematics is relatively low at the Division II level.

Yet many of the difficulties that predominate in grades four, five and six have their beginning at the primary level. The place value concepts, vitally important to the total program, starts its failing trend in grade one. Pupils begin to show a lack of understanding of the processes or actions involved in the operations at the grade one level as well.

Although the grade one pupils demonstrate a high level of recall of the basic facts, the grade two's begin to show a deficiency in this skill. This lack continues throughout the elementary grades and likely hampers some of the opportunities that students have for success in other areas. Teachers recognized this weakness in that they considered their students not to have mastery that would allow for the successful achievement of other dependent concepts.

The power of the textbook may be coming out in this study. Certainly the teachers rated it high as a reason for not being able to bring more students within the higher achievement category. How much influence the textbooks have on the achievement at the higher grades is perhaps speculative although there may be some relationships. For example an investigation conducted by the Ad Hoc Committee found during the development of the elementary program that the higher the grades the fewer the program objectives that are being treated in the authorized textbooks.

The problems that students have, from grade two and on, with regard to the introduction of the new (eg. multiplication after addition) operations, is likely a shared responsibility of the program, textbooks and the teachers handling of the instructional plans. This weakness is evidenced by the achievement figures.that show students to have increasing difficulties as the multiplication and division operations are incorporated into the program sequence with addition and subtraction.

The problems associated with the treatment of the operations may be in part responsible for the lack of performance in problem solving. From the time the process is introduced in grade two to the grade six level children do poorly.

The performance on Metric Measurement seems to deterioriate immediately following the successful introduction of non-standard measurement in grade one. It appears as though the grades four, five and six students have not had the opportunity to explore the metric concepts they would miss by coming into the program upstream. Students have utilized the Metric Systems for, at most, two years.

D. IMPLICATIONS FOR THE CURRICULUM

Some of the difficulties that appear to thread through the scope and sequence of mathematics objectives, grades one to six, may be due to particular weaknesses within the program and or with the inadequacies of the implementation process. It was not the intention of this study to delineate the causes so much as to find out if and where problems do exist. However it is possible to speculate about some of the apparent weaknesses that could influence the opportunities that children have to learn the mathematics that is intended for them.

One important consideration is that it does not appear to be sufficient to simply list the objectives within the strands and expect that the proper sequencing will be managed. Unless the textbooks do a better job of covering the content they too cannot provide the necessary bridging and spacing of the elementary mathematics content.

Pupil achievement in the area of place value may be an indication that methodology is not to be ignored. If the skills associated with place value are handled primarily in the abstract and in conjunction with the operations, students will likely continue to be frustrated.

Along this same line, the weaknesses that are associated with the money objectives may be in part due to their treatment in isolation from the supporting objectives in the Number and the Operations and Properties strands. This may also be applicable to the constructing of graphs.

The suggestion made in the Elementary Mathematics Handbook (1977) in relation to the importance of problem solving should be taken seriously. If it is as indicated "a unifying process which permeates all the strands of the program" (p. 21), then perhaps it should be given more treatment. Perhaps the topic of problem solving is important enough to have its own scope and sequence. Perhaps the topics within the other strands could be developed within the context of problem solving rather than the reverse.

The premise that commitment to memory is a negative influence on student understanding may be at work in the current program. The importance of memory storage, especially of the basic facts, should not be understated.

E. RECOMMENDATION FOR FURTHER RESEARCH

One major recommendation would be to reconsider the scope and sequence of the current program of studies for elementary school mathematics. Hopefully what would emerge is a more detailed plan that would pay more careful attention to seqencing in particular.

The diagnostic aspect of this study did not pin point for the teachers the specific problems which hinder student achievement in elementary school mathematics. The next step to a study such as this may be the development of programs to help teachers better diagnose the isolated mistakes and patterns of errors that children make, then to help build plans for the necessary corrective action.

Research shold be conducted into the reasons why Zone One students have so much difficulty with problem solving.

There is also room for more study into the curriculum and instruction of the Metric System of measurement within the elementary grades. More information is available now than was at the time of the program development in 1975 and 1976.

The above comment may also apply to the topic of transformational geometry although the main concern here is perhaps with the concepts and where they are to extend in subsequent geometry programs.

Another area that should be investigated is the degree to which teachers are able, through preparation or formal training, to diagnose pupil errors in mathematics and to prescribe effective treatment strategies to the difficulties revealed.

Finally one important area that this study failed to explore is that of the affective realm of the student. The feelings and attitudes of these children may turn out to be highly significant.

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APPENDIX A

THE AD HOC COMMITTEE'S
COMBINED SCHOOL ANALYSIS - QUESTIONNAIRE

COMBINED SCHOOL ANALYSIS

Elementary School Mathematics

Goals and Tentative Outline

Questionnaire

I am a

☐ teacher of grade __________

☐ principal

☐ other (Please Specify) _____________

Goals

After studying "The Goals of Elementary School Mathematics" I would like to make the following comments:

Tentative Outline

1. Could the majority of your pupils master the core program (objectives without asterisks)?

2. Do the optional areas (objectives with asterisks) provide sufficient enrichment and extension to meet the special needs and interests of pupils in your school or school system?

-2-

Please react to each of the following statements using the five-point scale:

1 — Strongly Agree
2 — Agree
3 — Unsure
4 — Disagree
5 — Strongly Disagree

	1	2	3	4	5	
NUMBER						
3. The core objectives in this strand represent at least a minimum level of content.						10/45/2/0/0
4. In view of the change to metric measure the increased emphasis on decimals is justified.						25/22/6/2/2
5. The sequence of concepts in this strand from level A to level F seems logically developed.						2/40/12/3/0
OPERATIONS AND PROPERTIES						
6. The core objectives in this strand represent at least a minimum level of content.						10/45/2/0/0
7. In view of the change to metric measure the decreased emphasis on the operations with common fractions is justified.						17/26/5/7/2
8. ALL operations with fractions are listed as enrichment or extension (E-II-9 ; F-II-10). This means that many pupils may not encounter these concepts until junior high school, This is too late.						8/16/13/11/4
9. There is adequate provision for drill and practice with the basic facts.						2/30/3/16/5
10. There is adequate provision for drill and practice in computation.						2/35/3/11/4
11. The sequence of concepts in this strand from level A to level F seems logically developed.						2/39/9/5/1

		1	2	3	4	5	
MEASUREMENT							
12.	The core objectives in this strand represent at least a minimum level of content.						8/69/1/2/0
13.	The use of metric units as the only standard units of measure to be taught is good.						20/36/5/4/1
14.	The sequence of introducing the metric units (m, cm, dm, l, kg, km, ml, g, tonne, mm) is a logical order.						8/36/5/0/2
15.	There is too much emphasis on time.						0/2/11/26/10
16.	Money should be introduced earlier in the core section.						0/15/10/12/8
17.	The sequence of introducing metric units parallels the sequence of introducing decimals.						1/29/18/8/0
18.	There should be more mention of the British units of measure.						0/6/6/30/9
19.	The sequence of concepts in this strand from level A to level F seems logically developed.						3/48/9/0/1
GEOMETRY							
20.	The core objectives in this strand represent at least a minimum level of content.						11/39/1/8/0
21.	Beginning with 3-dimensional figures (A-IV-1) is not realistic.						3/7/8/20/11
22.	There is too much emphasis on classifying.						2/1/12/29/5
23.	Removal of the point-set approach (points, lines, open and closed curves, etc.) from the primary grades is a backward step.						0/7/10/20/
24.	The sequence of concepts in this strand from level A to level F seems logically developed.						4/33/12/3/

	1	2	3	4	5	
GRAPHING						
25. The core objectives in this strand represent at least a minimum level of content.						5/43/2/4/0
26. Graphing is an important activity at all grade levels.						5/38/6/2/4
27. The sequence of concepts in this strand from Level A to level F seem logically developed.						4/33/10/3/0
GENERAL						
28. There is an adequate emphasis on skill development.						3/40/1/11/0
29. There is sufficient provision for problem solving activities.						1/30/3/17/4
30. There is a good balance between theory and application.						2/38/11/5/0

31. Please make specific comments on the "Tentative Outline." (Some of the above statements may provide the stimulus for some comment.)

Please return to:

Dr. W. George Cathcart
Department of Elementary Education
University of Alberta
Edmonton, Alberta
T6G 2G5

APPENDIX B

THE QUESTIONNAIRE

THE ZONE ONE ELEMENTARY
MATHEMATICS TESTING PROJECT

QUESTIONNAIRE

(Following the working paper on Mastery Learning)

November, 1978

Please return to:

Alberta Education
Field Services Branch
500 Nordic Court
10014 - 99 Street
Grande Prairie, Alberta
T8V 3N4

THE ZONE ONE ELEMENTARY
MATHEMATICS TESTING PROGRAM

Questionnaire

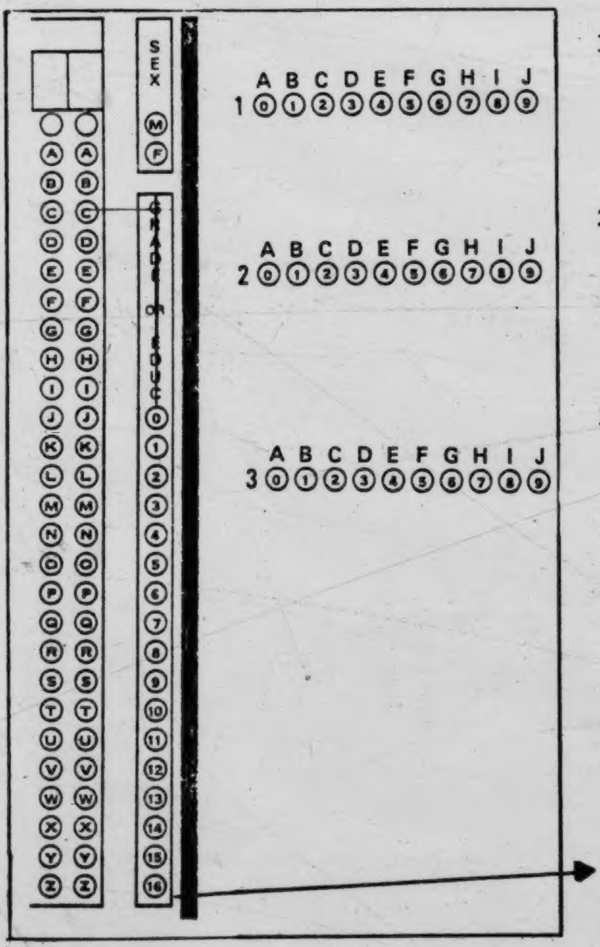
The purpose of this questionnaire is to obtain your perceptions about the mathematics achievement of students in your school system and the zone. I would appreciate your helping out in this exercise.

NOTE: (1) The objectives referred to in this questionnaire are those specifically outlined in the 1977 Elementary Mathematics Curriculum Guide.

(2) Please send the questionnaire to the Regional Office by December 15. They have been directed to hold all forms and to ship them in one group; individual anonymity will be preserved in this way. Would you kindly supply the additional information requested below.

(3) Please place answers to Questions on the Answer Sheet. Use pencil to record your responses and return only the Answer Sheet.

GENERAL PURPOSE — NCS — ANSWER SHEET



1. Pencil in the grade you teach. e.g. ⑥ Six
If you teach more than one grade choose only one and use it consistently throughout this questionnaire.

2. Pencil in the number (e.g. ⑤ five) that represents the number of years you have taught in Zone I elementary schools.
⓪ indicates 1st year - ⑨ means in your tenth year or more.

3. Pencil in the number that represents the total number of years you have been teaching.
⓪ indicates 1st year - ⑨ means in your tenth year or more.

Use this column to record your school system code. The one you used for the Zone I Testing Project. e.g. County of Grande Prairie 01 - record only 1. The zero's are not required here.

I. Below is a list of possible factors, labeled four (4) through eleven (11) that might influence the opportunities students have to achieve mastery (85% or above) levels on the elementary mathematics objectives.

4. There is a lack of good materials for teaching certain objectives.
5. Textbooks do not match the program objectives.
6. The program objectives for my grade level are too difficult.
7. The test items for my grade level are too difficult.
8. The varied abilities of my students makes instruction difficult.
9. The sequencing of content in our textbook is inappropriate.
10. Keeping track of failure and successes and subsequent follow-up is too difficult.
11. Students fail to master objectives because of inadequate learning skills (e.g., forgetting).

Please rank each of factors 4 through 11 as follows. From one ① the factor you think most likely explains why students in your system did not master the mathematics objectives, to eight ⑧, the factor you think least likely explains why students did not master the mathematics objectives (below 85%) (omit the zero ⓪)

NOTE: - only 8 factors.

	A	B	C	D	E	F	G	H	I	J
4	⓪	①	②	③	④	⑤	⑥	⑦	⑧	⑨
5	⓪	①	②	③	④	⑤	⑥	⑦	⑧	⑨
6	⓪	①	②	③	④	⑤	⑥	⑦	⑧	⑨
7	⓪	①	②	③	④	⑤	⑥	⑦	⑧	⑨
8	⓪	①	②	③	④	⑤	⑥	⑦	⑧	⑨
9	⓪	①	②	③	④	⑤	⑥	⑦	⑧	⑨
10	⓪	①	②	③	④	⑤	⑥	⑦	⑧	⑨
11	⓪	①	②	③	④	⑤	⑥	⑦	⑧	⑨

e.g. second most likely . . .

e.g. if you think 6 is the most likely factor, pencil in ①.

e.g. if you think 9 least likely explains, pencil in ⑧.

II. The following factors might be those which would contribute to a successful mathematics program in any school. (Factors labeled 12-18 for answer sheet purposes only.)

12. A instructional plan involving good teachable materials.

13. Textbooks that students like and which cover the program objectives.

14. A management plan that includes help for marking and ways and means of keeping track and following up with students.

15. A program that is geared to the ability levels of all children.

16. A classroom of children grouped so that their needs, abilities and interests are alike.

17. The professional training of the teachers in our system.

18. The continuous (inservice) education of teachers in our system in mathematics.

Please rank factors 12 through 18 as follows. From one ① the factor you think is the most important contributor for a successful mathematics program to seven ⑦ the factor you think is the least important for a successful mathematics program. (Omit the zero ⓪.)

	A	B	C	D	E	F	G	H	I	J
12	⓪	①	②	③	④	⑤	⑥	⑦	⑧	⑨
13	⓪	①	②	③	④	⑤	⑥	⑦	⑧	⑨
14	⓪	①	②	③	④	⑤	⑥	⑦	⑧	⑨
15	⓪	①	②	③	④	⑤	⑥	⑦	⑧	⑨
16	⓪	①	②	③	④	⑤	⑥	⑦	⑧	⑨
17	⓪	①	②	③	④	⑤	⑥	⑦	⑧	⑨
18	⓪	①	②	③	④	⑤	⑥	⑦	⑧	⑨

III. The third section of this questionnaire deals with the composite achievement scores of students at the Zone One level. For your reference the lowest non-mastery scores are recorded for objectives under each of the five strands, grades one to six. The concept areas are abbreviated also. Answer the questions which follow only for the grade you teach.

Grade One

Number	Oper. & Prop.	Measurement	Geometry	Graphing
5.Actually tests objective 6.renaming 72.7%	2.Symbolizes addit. & subt. sit. 73.9%	6.Recognizes coins & other values 68.3%	Mastery	1.Graphing data 78.6%

Grade Two

Number	Oper. & Prop.	Measurement	Geometry	Graphing
5.place value 65.1%	5.Solves picture & word problems 50.0%	4.Months in order 49.2%	3.Geometric pattern 75.0%	1.Construct bar & pictograph 69.4%

Grade Three

Number	Oper. & Prop.	Measurement	Geometry	Graphing
4.place value 45.4	9.solves word problems 56.0%	9.linear meas. to tenths 38.2%	4.Corresponding parts 48.8%	1.the axis 48.1%

Grade Four

Number	Oper. & Prop.	Measurement	Geometry	Graphing
8.tenths hundredths 9.6%	3.Rounding 37.0%	9.linear meas. to hundredths 12.8%	2.Axis of symmetry 44.4%	4.ordered pairs 45.6%

Grade Five

Number	Oper. & Prop.	Measurement	Geometry	Graphing
3.place value to 0.001 36.4%	6.Solve word problems 35.0%	9.equivalent measures 27.2%	2.Corresponding parts 38.2%	4.radius diam. & circumferences 41.8%

Grade Six

Number	Oper. & Prop.	Measurement	Geometry	Graphing
3.decimals & expanded notation 40.1%	6.Mult. & divides decimals 35.5	6.interrelationships 25.9	3.Constructs 3-D figures 43.7	2.ordered pairs 59.9

The following factors are those which may have contributed to the non-mastery status of Zone I students who, taken together, contributed to the lowest scores on the indicated objectives.

A. Students traditionally have difficulty with this topic.

B. The topic is new. Understanding will grow with teacher familiarity.

C. Students have not mastered previous concepts upon which this concept is dependent.

D. Instructional materials are lacking in this area.

E. This topic would not receive the instructional emphasis required for mastery.

F. This concept is beyond the ability of children at this particular grade level.

Which of the above factors do you think best explains the lowest Zone I scores in each of the five strands as outlined below. (Answer for the grade level you recorded in item one.)

Pencil in your choice of factors A, B, C, D, E, or F.
e.g. ⓪ ① ② ③ ④ ⑤

19. Number

A B C D E F G H I J
⓪①②③④⑤⑥⑦⑧⑨

20. Operations and Properties

A B C D E F G H I J
⓪①②③④⑤⑥⑦⑧⑨

21. Measurement

A B C D E F G H I J
⓪①②③④⑤⑥⑦⑧⑨

22. Geometry

A B C D E F G H I J
⓪①②③④⑤⑥⑦⑧⑨

23. Graphing

A B C D E F G H I J
⓪①②③④⑤⑥⑦⑧⑨

APPENDIX C

SUMMARY OF PILOTING DATA

GRANDE PRAIRIE SCHOOL DISTRICT #2357

- Elementary Mathematics Testing Project -

Summary of Trial Administration Data

Grades, One, Two, and Three

I. Background

During the 1976/77 school term, teachers in the District developed test items to match the objectives of the Alberta Education 1977 Mathematics Program.

During the 1977/78 school term, these items were organized into pilot tests by Al Anderson, Education Consultant, and Keith Wagner, Deputy Superintendent.

In December, 1977, and January, 1978, teachers in the District administered the tests to students in the grade level one grade beyond the grade the test is intended for. (That is, Grade Two students wrote the test intended for Grade One). The results are recorded on the following pages.

II. Purposes of Pilot

The purpose of this administration was to pilot the items. Scores were compiled because it was considered they would be useful information to assist in making judgements regarding the face validity of the items. These scores should in no way be considered a measure of the mathematics competence of students in the District.

If scores for an item are unduly low by comparison with overall scores, the following questions will be considered by a panel of teachers, the Deputy Superintendent, and the Education Consultant:

1. Is the item undesirable in some way?
   That is, could it be confusing to a student and thus not really measure his knowledge of the objective?
2. Could students have achieved poorly because the program they were exposed to in the previous year did not contain the objective being measured?
   If so, the question may well be suitable.

It is hoped that revisions based on this type of analysis will result in a final test instrument that will accurately reflect the competence of the students, objective by objective.

LEVEL A (Grade 1)

Number of Classes = 11 Number of Students = 233	Total Possible	Total Actual	% Of Achievement
NUMBER			
1. Matches members of two sets and determines equivalent and non-equivalent sets.	1,398	1,349	96.49
2. Describes relationships such as more, fewer, greater than, less than, equal to. (no symbols)	1,398	1,234	88.26
3. Associates a numeral with equivalent sets. (0-9) Cardinality.	2,330	2,313	99.27
4. Demonstrates knowledge of the order property of numbers by ordering sets by relative size, by counting, and by arranging digits in order. (Ordinality)	1,864	1,636	87.77
5. Reads and writes numerals. (0-99)	-	-	-
6. Identifies and renames the number of 10's and the number of 1's in any 2 digit number.	2,330	1,522	65.32
	9,320	8,054	86.42
OPERATIONS AND PROPERTIES			
1. Understands the process of addition and subtraction.	932	912	97.85
2. Symbolizes addition and subtraction situations.	2,330	1,798	77.16
3. Demonstrates mastery of the basic facts involving sums and minuends through 9.	3,728	3,442	92.33
	6,990	6,152	88.01
MEASUREMENT			
1. Tells the time to hour.	466	447	95.92
2. Recites the days of the week in order.	233	202	86.70

3. Compares two or more objects as shorter than, longer than, thinner than, thicker than, heavier than, lighter than, etc.	699	666	95.28
4. Estimates and measures using non-standard units of capacity, mass and linear measures.	699	590	84.41
5. Identifies instruments for measuring time, mass, length, capacity and temperature.	1,165	1,057	90.73
6. Recognizes pennies, nickles, dimes and quarters, and the value of each.	699	639	91.42
	3,961	3,601	90.91
GEOMETRY			
1. Classifies, by manipulation, 3-dimensional objects according to various attributes.	932	358	38.41
2. Recognizes and names: circle, square, triangle, rectangle.	932	869	93.24
	1,864	1,227	65.83
GRAPHING			
1. Collects data from immediate environment and constructs graphs using pictures or objects.	1,165	757	64.98
	1,165	757	64.98

LEVEL B (Grade 2)

Number of Classes = 9 Number of Students = 226	Total Possible	Total Actual	% Of Achievement
NUMBER			
1. Identifies the cardinal number associated with a set of objects.	5,424	5,004	92.26
2. Orders numerals and recognizes "betweenness." (0-100)	4,520	4,416	97.70
3. Reads and writes numerals. (0-999)	5,424	5,308	97.86
4. Names ordinals first to tenth.	5,424	5,108	94.17
5. Identifies the number of 100's, 10's and 1's in a given three-digit numeral.	5,424	5,176	95.43
6. Identifies multiples by counting by 5's, 10's and 100's.	6,328	6,048	95.58
7. Identifies and represents fractions (halves and quarters) in a concrete setting.	3,616	2,824	78.10
	36,160	33,884	93.71
OPERATIONS AND PROPERTIES			
1. Symbolizes addition and subtraction situations in both the horizontal and vertical form.	1,808	1,176	65.04
2. Understands the basis of the commutative property for addition.	2,712	1,951	71.94
3. Understands the processes of multiplication and division.	2,712	1,556	57.37
4. Demonstrates mastery of basic facts involving sums and minuends to 18.	7,232	5,474	75.69
5. Solves picture and word problems. Estimates answers.	5,424	2,641	48.69
6. Adds and subtracts to 99 with no regrouping.	7,232	5,801	80.21
	27,120	18,599	68.58

MEASUREMENT			
1. Tells the time to hour, half hour, and quarter hour.	452	385	85.18
2. Writes the hour, half hour and quarter hour using standard notation.	452	266	58.85
3. Reads the dates on the calendar.	904	639	70.69
4. Recites months of the year in order.	904	464	51.33
5. Estimates and uses standard units of length, capacity, and mass, m, cm, ℓ, kg .	2,712	1,426	52.58
6. Identifies proper measuring instruments for a given task.	2,712	2,504	92.33
7. Reads the Celsius thermometer to ten degree intervals.	904	687	76.00
8. Counts collections of coins up to 25¢.	904	715	79.09
9. Gives equivalent value of coins to 25¢.	2,712	2,250	82.96
10. Makes purchases up to 25¢.	904	757	83.74
	13,560	10,093	74.43
GEOMETRY			
1. Classifies 3-dimensional objects in relation to corners, edges, and faces.	1,808	1,270	70.24
2. Classifies 2-dimensional figures in relation to boundaries, corners and faces.	1,808	1,270	70.24
3. Develops geometrical patterns using 3-dimensional objects and 2-dimensional figures.	2,712	1,990	73.38
	6,328	4,530	71.59

GRAPHING			
1. Constructs simple bar and pictographs using data collected from immediate environment.	2,712	1,526	56.27
2. Locates position of an object on a 10 x 10 grid.	4,520	3,819	84.49
	7,232	5,345	73.91

LEVEL C (Grade 3)

Number of Classes Number of Students	Total Possible	Total Actual	% Of Achievement
NUMBER			
1. Orders and determines "betweenness" of whole numbers (0-1 000) and understands symbols >, < and = to show relationships.	4,040	3,562	88.17
2. Identifies multiples by counting by 2's, 5's, 10's, 25's, 100's (0-1 000).	3,232	2,436	75.37
3. Reads and writes numerals. (0-9 999).	6,464	5,832	90.22
4. Identifies the number of 1 000's, 100's, 10's, 1's and tenths.	2,424	878	36.22
5. Rewrites numbers in expanded notation (0-1 000) and vice versa.	3,232	2,644	81.81
6. Reads and writes decimals to tenths.	3,232	3,152	97.52
7. Identifies, writes and compares fractions from physical representation (halves, quarters, tenths, and fifths).	4,848	2,999	61.86
	27,472	21,503	$\boxed{78.27}$
OPERATIONS AND PROPERTIES			
1. Identifies additive, subtractive, multiplicative and divisive situations.	2,424	1,848	76.24
2. Adds and subtracts two or three digit numbers with and without regrouping.	4,848	3,952	81.52
3. Symbolizes multiplication and division situations.	1,616	1,450	89.73
4. Identifies related sentences for addition, subtraction, multiplication and division.	2,424	1,709	70.50
5. Understands the basis of the commutative property of addition and multiplication.	1,616	1,229	76.05
6. Understands the unique effect of 0 and 1 in addition and multiplication respectively.	1,616	1,210	74.88
7. Demonstrates mastery of basic facts involving sums, minuends, products and dividends to 18.	4,848	3,679	75.89

8. Multiplies whole numbers by 10 and 100.	1,616	1,414	87.50
9. Solves word problems. Estimates answers.	3,232	1,618	50.06
	24,240	18,109	74.71
MEASUREMENT			
1. Tells and writes the time to the nearest hour, half hour, quarter hour and five minute intervals.	808	697	86.26
2. Knows the months of the year in order.	808	572	70.79
3. Uses noon, midnight, a.m. and p.m.	1,616	1,399	86.57
4. Counts collections of coins up to $1.00.	1,616	1,262	78.09
5. Makes purchases and change up to $1.00.	1,616	735	45.48
6. Read Celsius thermometer to one degree intervals.	808	604	74.75
7. Extends estimation and measurement to include the use of the standard units km, dm .	2,424	1,026	42.33
8. Uses standard instruments, (metre stick, litre container, mass scales, calendar, Celsius thermometer).	4,040	3,006	74.41
9. Expresses linear measurement to the nearest tenth.	808	56	7.93
	14,544	9,357	64.34
GEOMETRY			
1. Classifies and identifies 2-dimensional figures and 3-dimensional objects.	1,616	1,500	92.82
2. Constructs 2-dimensional figures using straws, pipecleaners, wires, geoboard, etc.	2,424	2,244	92.57
3. Constructs 3-dimensional objects with Plasticine or modeling clay.	4,040	1,632	40.40
4. Recognizes corresponding parts in polygons.	808	386	47.77
	8,888	5,762	64.83

GRAPHING			
1. Identifies the axes.	404	90	22.28
2. Collects data and constructs simple bar, line and pictographs.	2,424	934	38.53
3. Locates position of an object on a grid.	2,020	900	44.55
4. Plots points on a grid when given the two co-ordinates.	808	470	58.17
	5,656	2,394	42.33

APPENDIX D

THE CLASS ANALYSIS FORM

GRADE FIVE MATHEMATICS TEST

CLASS ANALYSIS FORM

______________________ Teacher

______________________ School

This form is to be kept in the school records, and a copy is to be sent to Central Office to assist in a District analysis of results and norming process.

NUMBER OF STUDENTS IN CLASS = X = ______			
	OBJECTIVE	POSSIBLE	ACTUAL
NUMBER	1	20x	
	2	20x	
	3	14x	
	4	20x	
	5	16x	
	6	16x	
	TOTAL:	106x	
	OBJECTIVE	POSSIBLE	ACTUAL
OPERATIONS & PROPERTIES	1	8x	
	2	6x	
	3	6x	
	4	8x	
	5	16x	
	6	28x	
	7	18x	
	TOTAL:	90x	
	OBJECTIVE	POSSIBLE	ACTUAL
MEASUREMENT	1	2x	
	2	4x	
	3	3x	
	4	4x	
	5	3x	
	6	2x	
	7	7x	
	8	6x	
	9	7x	
	10	4x	
	TOTAL:	42x	

APPENDIX E

DETAILED MARK WEIGHTING EXAMPLE

DISTRIBUTION OF MARKS BY STRAND

Number Strand

	Obj. 1	20 marks	Obj. 4	20 marks	
	Obj. 2	20 marks	Obj. 5	16 marks	
	Obj. 3	14 marks	Obj. 6	16 marks	
TOTAL		54	+	52	= 106 marks

Operations and Properties Strand

	Obj. 1	8 marks	Obj. 5	16 marks	
	Obj. 2	6 marks	Obj. 6	28 marks	
	Obj. 3	6 marks	Obj. 7	18 marks	
	Obj. 4	8 marks			
TOTAL		28	+	62	= 90 marks

Measurement Strand

	Obj. 1	2 marks	Obj. 6	2 marks	
	Obj. 2	4 marks	Obj. 7	7 marks	
	Obj. 3	3 marks	Obj. 8	6 marks	
	Obj. 4	4 marks	Obj. 9	7 marks	
	Obj. 5	3 marks	Obj. 10	4 marks	
TOTAL		16	+	26	= 42 marks

Geometry Strand

	Obj. 1	12 marks	Obj. 3	8 marks	
	Obj. 2	8 marks	Obj. 4	7 marks	
TOTAL		20	+	15	= 35 marks

Graphing Strand

	Obj. 1	9 marks	Obj. 4	4 marks	
	Obj. 2	6 marks	Obj. 5	4 marks	
	Obj. 3	4 marks			
TOTAL		19	+	8	= 27 marks

TOTAL = 300 marks

GRADE FIVE MATHEMATICS TEST

PART II

DETAILED ANALYSIS OF MARK WEIGHTINGS

PART	QUESTION	STRAND	OBJECTIVE	RAW SCORE VALUE
II	1	Measurement	1	1
II	2	Measurement	1	1
II	3	Measurement	2	4
II	4	Measurement	3	3
II	5	Measurement	4	4
II	6	Measurement	5	3
II	7	Measurement	6	2
II	8	Measurement	7	3
II	9	Measurement	7	4
II	10	Measurement	8	6
II	11	Measurement	9	1
II	12	Measurement	9	2
II	13	Measurement	9	4
II	14	Measurement	10	4

SUB-TOTAL = 42

SUB TOTAL ÷ 3 = 14%

APPENDIX F

THE STUDENT ANALYSIS FORM - 1978

School System ________

School ________

GRADE FIVE MATHEMATICS TEST

STUDENT ANALYSIS FORM - PAGE 1

Name: ____________________ Grade 5 Male or Female ______ Birthdate: ____________

- PART I -

QUESTION BASIS

NO.	POSSIBLE	ACTUAL
1	20	
2	20	
3	8	
4	6	
5	20	
6	16	
7	10	
8	6	
9	8	
10	6	
11	6	
12	4	
13	4	
14	6	
15	6	
16	8	
17	8	
18	6	
19	6	
20	6	
21	4	
22	4	
23	4	
24	4	
Total	196	

OBJECTIVE BASIS

NUMBER STRAND

OBJ.	CORRS. QUES.	POSSIBLE	ACTUAL
1	1	20	
2	2	20	
3	3, 4	14	
4	5	20	
5	6	16	
6	7, 8	16	
TOTAL:		106	

OPERATIONS AND PROPERTIES STRAND

OBJ.	CORRS. QUES.	POSSIBLE	ACTUAL
1	9	8	
2	10	6	
3	11	6	
4	12, 13	8	
5	21,22,23,24	16	
6	14,15,16,17	28	
7	18, 19, 20	18	
TOTAL:		90	

APPENDIX G

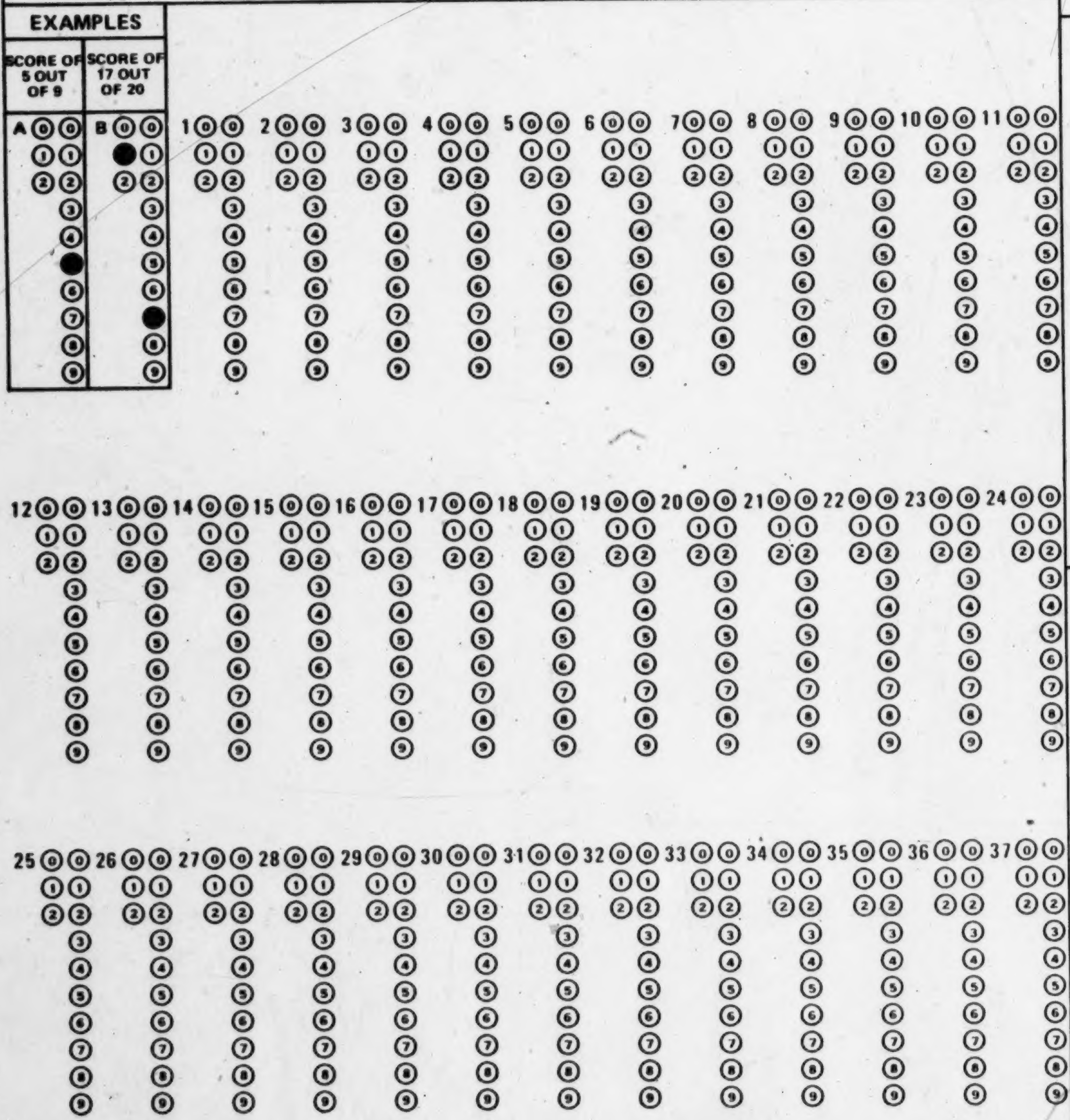
THE ANSWER SHEET - 1979

SIDE 2

PART II

(GRADE FOUR USE THIS SIDE FOR PART III AND IV)

STUDENT PROFILES WILL BE MADE FROM THESE ANSWER SHEETS–PLEASE CHECK THEM


EXAMPLES
SCORE OF 5 OUT OF 9
SCORE OF 17 OUT OF 20
A
B
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
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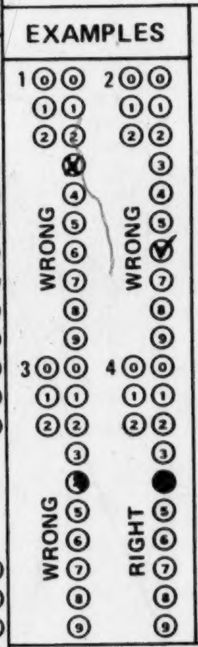
33
34
35
36
37

ZONE ONE
ELEMENTARY MATHEMATICS TESTS
ANSWER SHEETS

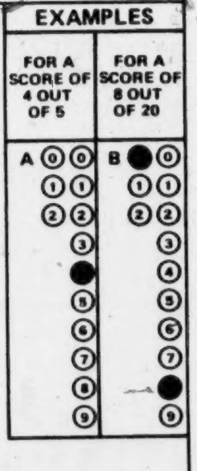

EXAMPLES
1
2
WRONG
WRONG
3
4
WRONG
RIGHT

IMPORTANT DIRECTIONS FOR MARKING ANSWERS

- Use black lead pencil only (Hb or softer)
- DO NOT use ink or ballpoint pens
- Make heavy black marks that fill the circle completely
- Erase cleanly any answer you wish to change
- Make no stray marks on the answer sheet

IMPORTANT

- Please use the Direction pages to record your school system, school, Early and Late codes and student name.
- After correcting student tests use the Answer Key and Teachers Guide to accurately transfer the one or two digit responses to this sheet.
  Example: For questions with one digit totals fill in only the ones column. For questions with two digit totals use the tens and the ones column.


EXAMPLES
FOR A SCORE OF 4 OUT OF 5
FOR A SCORE OF 8 OUT OF 20
A
B

APPENDIX H

THE ADMINISTRATIVE DIRECTIONS

ZONE ONE

ELEMENTARY MATHEMATICS TESTING PROJECT

COORDINATOR
AL ANDERSON
5804 - 109th AVENUE
EDMONTON, ALBERTA
T6A 1S2

May 4, 1979

Dear Teacher,

Thank you for participating in year two of the Zone I Elementary Mathematics Testing Project.

As indicated earlier, for cost and comparative reasons the tests will be identical to the 1978 forms. Should some type of testing continue for next year, suitable alterations will be made for that re-printing.

ADMINISTRATIVE DIRECTIONS

The following errors were notes from your communications. Please ensure that they are recorded in your Teachers' Guides and Answer Keys.

Grade I

(a) Question #13, Geometry, Measurement Graphing Strand. This item is judged as measuring the value of coins - have the students do the item even though it may be inappropriate.

(b) Question #21, (lab section). Use the 50 ml to have each student fill only one of the larger containers. The specifying of these containers is for uniformity purposes. The item is intended to measure non-standard units as the objective states.

(c) Question #22, (lab section) should be revised in the Teachers Manual according to the directions given in the Answer Key; Specifically, five - 4 g boxes are required.

Grade II

(a) Question #11, Measurement, Geometry Graphing Strand. Answers are wrong if the order is incorrect however, do not deduct for missing commas.

Grade III Answer Key

(a) Question 30, Number. The marks for this question were in error given to objective 5 in the Operations and Properties strand. This has been corrected by computer.

ZONE ONE

ELEMENTARY MATHEMATICS TESTING PROJECT

COORDINATOR
AL ANDERSON
5804 - 109th AVENUE
EDMONTON, ALBERTA
T6A 1S2

(b) Question #8, Number, Operations and Properties Strand. The answer should be 11.6 not 11.5.

(c) Question #10, Measurement, Geometry and Graphing. If the student gives all the correct points but leaves the line, give 3 marks.

(d) Question #20 and 21, (pg. 9 and 10) of the Geometry, Measurement Graphing Strand. The marks for these questions are correctly given in the Answer Key. The computer makes the adjustment for analysis.

Grade IV

(a) Question #13, page 4, Number. Students may need help to see that a one number response is required for each section. e.g. not 6, .8, .13 for A.

(b) Question #7, on page 2 of Number, A Crayon is not necessary - pencil shading will do.

(c) Question #24, on page 9. Operations and Properites. This item relates to a grade 5 objective. We will take that into account.

Grade VI - Answer Key - Operations and Properties

(a) Question #4-B, page 2. The answer should read hundreds, not thousands.

(b) Question #14, page 6. The answer should be 365940.

(c) Question #16-d, page 7, The answer should read 6.7 not 27.608.

There may be other questionable aspects within each test. Please try to bear with them.

Please examine the directions on the Zone One Elementary Mathematics Tests Answer Sheets. Because over 14000 students are being tested it will be impossible for us to check them over. Soft pencil must be used to fill in the complete circles as shown in the example. If this is not done carefully, the optical scorer will not record the student responses. You might wish to check your student Answer Sheets prior to sending them in. Please note the solution for transfering the 49 questions in Part I of Grade 3 to Answer sheets.

The optical scoring system will speed the analysis process up. Should you wish to administer the tests during the first week of June (4 - 11), I will endeavour to return them to your schools prior to June 30. At any regard we should not be facing the delays we did last year.

Sorry that we cannot eliminate the marking and mark transferring time.

ELEMENTARY MATHEMATICS TESTING PROJECT

ZONE ONE

COORDINATOR
AL ANDERSON
5804 - 109th AVENUE
EDMONTON, ALBERTA
T6A 1S2

THE LAB MATERIALS

1. Make sure that all of your lab materials are available prior to your testing sessions.

The materials listed by grade are those items required for the lab sections of each test.

Grade 1

o 1. A flannelboard or magnetic board and felt or magnetic shapes (most schools have these).

* 2. Paper clips - 10 per student
3 boxes per class (100 each box)

* 3. Wooden pegs - Scholars Choice
200 per school is adequate
(Note: Scholars Choice cannot supply these. I have taken the liberty of having Spectrum supply an alternate.)

* 4. One 50 ml, one 250 ml, one 400 ml
F Tri-Pour Beaker Set (set of 6) from Spectrum

* 5. Ten 10 gram mass chips. M Primary Mass Set from Spectrum

o 6. 5 small boxes (match box size) with a mass of about 4 g each (tape up for strength).

* 7. 1 balance scale (including 2 buckets) from Spectrum

* The lab materials ordered by your school or central office.

o To be prepared or supplied by your school.

Grade 2

o 1. A square sheet of cardboard divided into quarters with one-quarter colored black (about 25 cm x 25 cm).

o 2. 3 flashcards (prepare these)
   (a) with number 798
   (b) with number 401
   (c) with number 267

(Large enough for whole class to see)

Grade 2 (Continued)

* 3. A class set of cm rulers--many will have these now. The one listed here shows the dm-cm relationship which is needed for Grade 3. Order from Spectrum.
* 4. 1 ice cream bucket (plastic--approximately 2 litres). These come with the pan balance kit.
* 5. One 4 - 5 litre bucket with a tape marking at the 3 and 4 litre levels. G plastic pail--2 gallon from Spectrum.
* 6. A 1 litre bucket--this is provided in the Grade 1 Tri-Pour Set.

o 7. 2 boxes filled with material (sand, dirt, cement, etc.). One 2 kg and the other 3 kg.

* 8. Balance scale--the one for Grade 1.
* 9. 4 kg masses. L Hex Mass from Spectrum.

Grade 3

o 1. Flannelboard or magnetic board as for Grade 1.

* 2. Rulers as for Grade 1.
* 3. A chunk of plasticine for each student. Order from Spectrum.

Grade 4

* 1. cm rulers as for Grades 1, 2, and 3.

CORRECTING THE TESTS

The Answer Keys are provided for correcting the tests you Administer. Please note the corrections outlined earlier. Transfer the scores for each item to the corresponding number on the Answer Sheet for each Student.

The grade three test Part I poses a special problem. Part I has 49 questions while the Answer Sheets allow only 37 answer spaces. Please note how to transfer the marks for question 38 to 49 on the Part II side of the Answer Sheet on the next page.

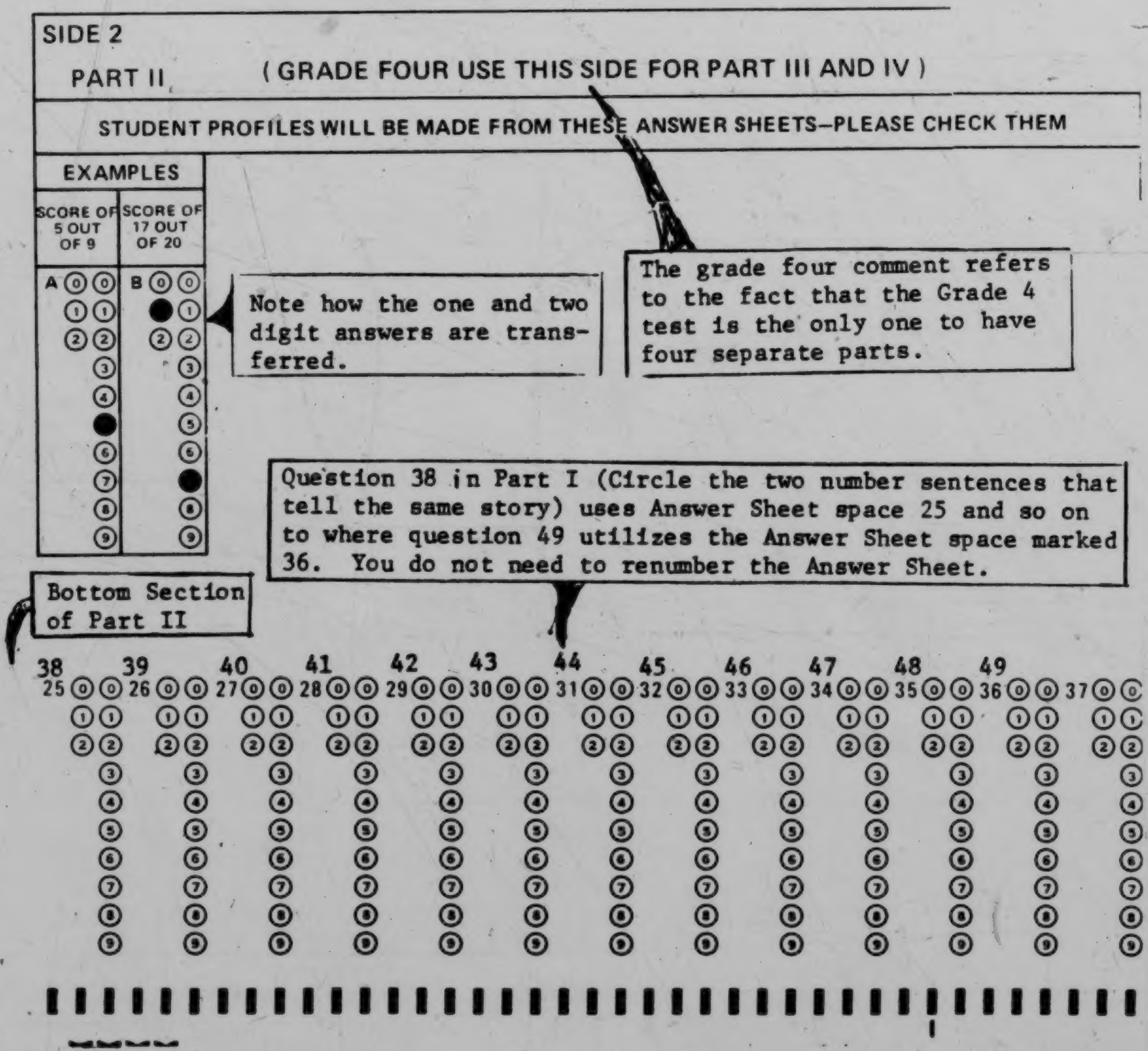
elementary mathematics testing project

ZONE ONE

COORDINATOR
AL ANDERSON
5804 - 109th AVENUE
EDMONTON, ALBERTA
T6A 1S2

ZONE ONE ELEMENTARY MATHEMATICS ANSWER SHEETS

The same answer sheet (red lettering) as enclosed will be used for each grade level. For this reason there are more answer spaces than questions. Grade three caused us some problem. We were unable to include more than 37 answer spaces on one side. Part 1 of grade three has 49 questions. This leaves us 12 spaces short. To accomodate this the optical scorer has been directed to use the last line of side two of the answer sheet. Specific directions are included below. Sorry for this inconvenience.



SIDE 2

PART II (GRADE FOUR USE THIS SIDE FOR PART III AND IV)

STUDENT PROFILES WILL BE MADE FROM THESE ANSWER SHEETS—PLEASE CHECK THEM

EXAMPLES

SCORE OF 5 OUT OF 9	SCORE OF 17 OUT OF 20
A	B

Note how the one and two digit answers are transferred.

The grade four comment refers to the fact that the Grade 4 test is the only one to have four separate parts.

Question 38 in Part I (Circle the two number sentences that tell the same story) uses Answer Sheet space 25 and so on to where question 49 utilizes the Answer Sheet space marked 36. You do not need to renumber the Answer Sheet.

Bottom Section of Part II

ELEMENTARY MATHEMATICS TESTING PROJECT

ZONE ONE

COORDINATOR
AL ANDERSON
5804 - 109th AVENUE
EDMONTON, ALBERTA
T6A 1S2

SCHOOL SYSTEM NUMBER		SCHOOL NUMBER			GRADE	SEX
●	0	●	0	0		Ⓜ MALE
1	1	1	●	1	1	● EMALE
2	●		2	●	2	**EARLY OR LATE STARTERS**
	3		3	3	3	
	4		4	4	4	
	5		5	5	●	
	6		6	6	6	
	7		7	7		● ARLY
	8		8	8		Ⓛ ATE
	9		9	9		

Record all the digits which are used to identify both school system and school.
e.g. 02 East Smokey S.D.
#54 012 Fox Creek.

STUDENT NAME (Last, First)

J	a	c	K	s	o	n			C								
○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
A	●	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B
C	C	●	C	C	C	C	C	C	●	C	C	C	C	C	C	C	C
D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D
E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E
F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F
G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G
H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H
I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I
●	J	J	J	J	J	J	J	J	J	J	J	J	J	J	J	J	J
K	K	K	●	K	K	K	K	K	K	K	K	K	K	K	K	K	K
L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L
M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M
N	N	N	N	N	N	●	N	N	N	N	N	N	N	N	N	N	N
O	O	O	O	O	●	O	O	O	O	O	O	O	O	O	O	O	O
P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P
Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q
R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
S	S	S	S	●	S	S	S	S	S	S	S	S	S	S	S	S	S
T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T
U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V
W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W
X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z

NCS Trans-Optic 08-6874:54321

Jackson Cathy
Grade 5
Female
Early Starter
(From next page)

By recording the student's name on the answer sheet as shown, Cathy's name will appear on the print-out. The last name must begin with the first letter on the far left column. Last name and initial of first name is sufficient. (Fill in letters)

ZONE ONE

ELEMENTARY MATHEMATICS TESTING PROJECT

COORDINATOR
AL ANDERSON
5804 - 109th AVENUE
EDMONTON, ALBERTA
T6A 1S2

EARLY AND LATE STARTERS

Record an E or an L for each student according to the following categories.

Grade	If the student's birthday is *before*	If the student's birthday is *after*
Grade 1	Sept. 5, 1972 record Early	Sept. 5, 1972 record Late
Grade 2	Sept. 5, 1971 record an E	Sept. 5, 1971 record an L
Grade 3	Sept. 5, 1970 record an E	Sept. 5, 1970 record an L
Grade 4	Sept. 5, 1969 record an E	Sept. 5, 1969 record an L
Grade 5	Sept. 5, 1968 record an E	Sept. 5, 1968 record an L
Grade 6	Sept. 5, 1967 record an E	Sept. 5, 1967 record an L

SCHOOL DIVISIONS AND SCHOOLS

01 County of Grande Prairie #1
02 East Smoky S.D. #54
03 Fairview S.D. #50
04 Fort Vermilion S.D. #52
05 Grande Prairie S.D. #2357
06 High Prairie S.D. #48
07 Northland S.D. #61
08 Peace River S.D. #10

ELEMENTARY MATHEMATICS TESTING PROJECT

ZONE ONE

COORDINATOR
AL ANDERSON
5804 - 109th AVENUE
EDMONTON, ALBERTA
T6A 1S2

09 Spirit River S.D. #47

10 Roman Catholic Separate Schools

Grande Prairie RCSSD #28
Beaverlodge RCSSD #68
Sexsmith RCSSD #51

11 St. Thomas More RCSSD #35

12 North Peace Separate Schools

13 South East Peace Catholic Authority

14 Independent Schools

15 Grovedale S.D. #4910

16 Calgary S.D. #19

17 County of Lamont

18 Red Deer RCSSD

19 County of Thorhild

20 Jasper School Division

21 Three Hills School Division

22 Taber School Division

* * * * * * *

01 County of Grande Prairie #1

- 001 Beaverlodge Elementary
- 002 Bezanson
- 003 Elmworth
- 004 Grandview Colony
- 005 Harry Balfour
- 006 Hythe Elementary
- 007 La Glace
- 008 Sexsmith Public
- 009 Teepee Creek
- 010 Valhalla
- 011 Wembley

02 East Smoky S.D. #54

- 012 Fox Creek
- 013 Harry Gray Elementary
- 014 Harry Gray Primary
- 015 Ridgevalley
- 016 Ridgevalley Colony
- 017 Sunset House

03 Fairview S.D. #50

- 018 Bear Canyon Central
- 019 Fairview Elementary
- 020 Hines Creek
- 021 Menno Simons
- 022 Whitelaw
- 023 Worsley Central

ELEMENTARY MATHEMATICS TESTING PROJECT

ZONE ONE

COORDINATOR
AL ANDERSON
5804 - 109th AVENUE
EDMONTON, ALBERTA
T6A 1S2

04 Fort Vermilion S.D. #52

024 Assumption
025 Buffalo Head Prairie
026 Fort Vermilion Public
027 High Level Public
028 La Crete Public
029 North Tallcree
030 Rainbow Lake
031 Rocky Lane
032 Sandhills Elementary
033 South Tallcree
034 Upper Hay River
035 Zama City

05 Grande Prairie S.D. #2357

036 Avondale Elementary
037 Hillside Elementary
038 Parkside Elementary
039 Swanavon Elementary

06 High Prairie S.D. #48

040 C.J. Schurter Elementary
041 Carole Bannister
042 Driftpile
043 E.G. Wahlstrom
044 Georges P. Vanier

06 High Prairie S.D. #48 (Continued)

045 Girouxville
046 High Prairie Elementary
047 Jean Cote
048 Joussard
049 Kinuso
050 Langlois
051 McLennan Public
052 Prairie River Elementary

07 Northland S.D. #61

053 Atikameg-Sovereign
054 Bishop Routhier
055 Cadotte Lake
056 Calling Lake
057 Chipewyan Lakes
058 Conklin
059 Dr. Mary Jackson
060 Elizabeth Colony
061 Fort Chipewyan Public
062 Fort MacKay
063 Garden Creek
064 Gift Lake
065 Grouard
066 J.F. Dion

ELEMENTARY MATHEMATICS TESTING PROJECT

ZONE ONE

COORDINATOR
AL ANDERSON
5804 - 109th AVENUE
EDMONTON, ALBERTA
T6A 1S2

07 Northland S.D. #61 (Continued)

- 067 Janvier
- 068 Jean Baptiste Sewepegaham
- 069 Jean D'or Prairie
- 070 Kateri
- 071 Little Buffalo
- 072 Loon Lake
- 073 Mistassiniy
- 074 Nose Creek
- 075 Paddle Prairie
- 076 Peerless Lake
- 077 Pelican Mountain
- 078 St. Theresa

08 Peace River S.D. #10

- 079 Brownvale
- 080 Deadwood
- 081 Dixonville
- 082 Kennedy Elementary
- 083 Lloyd Garrison
- 084 Manning Elementary
- 085 McGrath Elementary
- 086 Nampa Public
- 087 Springfield Elementary

09 Spirit River S.D. #47

- 088 Blueberry Creek
- 089 Bonanza
- 090 Eaglesham
- 091 Rycroft
- 092 Savanna
- 093 Spirit River Elementary
- 094 Wanham
- 095 Woking

10 Roman Catholic Separate Schools

Grande Prairie RCSSD #28

- 096 Holy Cross
- 097 St. Clement Elementary
- 098 St. Gerard Elementary

Beaverlodge RCSSD #68

- 099 St. Mary's

Sexsmith RCSSD #51

- 100 St. Mary's

11 St. Thomas More RCSSD #35

- 101 St. Thomas More

12 North Peace Separate Schools

- 102 Fort Vermilion RCSSD #26 - St. Mary's Separate
- 103 Grimshaw RCSSD #88 - Holy Family

ELEMENTARY MATHEMATICS TESTING PROJECT

ZONE ONE

COORDINATOR
AL ANDERSON
5804 - 109th AVENUE
EDMONTON, ALBERTA
T6A 1S2

North Peace Separate Schools (Continued)

104 Nampa RCSSD #96 - Nampa Separate

105 Peace River RCSSD #43 - Glenmary

106 Peace River RCSSD #43 - Immaculate Conception

107 Rosary RCSSD #37 - Rosary

13 South East Peace Catholic Authority

108 Falher Consolidated School Dist. #69 - Routhier

109 High Prairie RCSSD #56 - St. Andrew's

110 McLennan RCSSD #30 - Providence

111 Spirit River RCSSD #36 - St. Marie

112 Valleyview RCSSD #84 - St. Stephen's

14 Independent Schools

113 Peace River Junior Academy

114 Maranatha Junior Academy

15 Grovedale S.D. #4910

115 Grovedale Penson Elementary

16 Calgary S.D. #19

116 Sam Livingston Elementary

117 Albert Park Elementary

17 County of Lamont

118 Chipman School

17 County of Lamont (Continued)

119 Lamont School

120 Mundare School

121 Andrew School

18 Red Deer RCSSD

122 St. Thomas Aquinas

123 Mont Fort Elementary

126 Maryview Elementary

127 St. Elizabeth Seton

128 St. Martin de Porres

19 County of Thorhild

124 Thorhild Elementary

129 Radway School

130 Newbrook School

20 Jasper School Division

125 Jasper Elementary

21 Three Hills School Division

131 Acme School

132 Carbon School

133 Huxley School

134 Lindon School

135 Three Hills

136 Turrington

ELEMENTARY MATHEMATICS TESTING PROJECT

ZONE ONE

COORDINATOR
AL ANDERSON
5804 - 109th AVENUE
EDMONTON, ALBERTA
T6A 1S2

21 Three Hills School Division (Continued)

137 Trochu
138 Wimborne
139 Valleyview Colony
140 Huxley Colony

22 Taber School Division

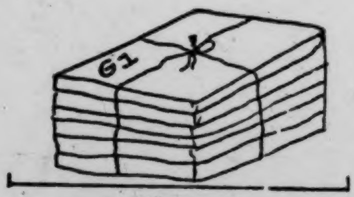
141 Barnwell School
142 Chamberlain School

22 Taber School Division (Continued)

143 Enchant School
144 Hays School
145 Central School
146 Dr. Hamman School
147 L.T. Westlake School
148 Vauxhall School

WHERE THE TEST MATERIALS GO

You may keep all
student tests for
the present time.



Teacher Manuals
Marking Keys
Unused student
tests in separate
envelopes by
grade level
are to te sent to
your central office.

Please send your School's
Answer sheets separated by
Grade directly to:
A. L. Anderson
Grande Prairie Regional Office
500 Nordic Court
10014 - 99 St.
Grande Prairie, Alberta
T8V 3N4

Thank you again for the work you have undertaken to make this project possible. If you have any special problems call the Grande Prairie Regional Office at 539-2130 or Edmonton (432-2950).

Al Anderson

A.L. Anderson

APPENDIX I

PARTICIPATING SCHOOL SYSTEMS WITH SCHOOL AND PUPIL COUNTS IN 1978

SCHOOL DIVISIONS	NUMBER OF SCHOOLS	I	II	III	IV	V	VI
County of Grande Prairie #1	11	274	301	267	261	259	261
East Smoky S.D. #54	6	217	172	179	197	184	195
Fairview S.C. #50	6	168	146	146	143	144	114
Fort Vermilion S.D. #52	12	454	398	375	303	279	263
Grande Prairie S.D. #2357	4	303	275	240	233	262	264
High Prairie S.D. #48	13	367	323	318	291	313	327
Northland S.D. #61	26	300	423	300	347	356	300
Peace River S.D. #10	9	230	240	214	226	251	240
Spirit River S.D. #47	8	143	163	153	145	155	161
Roman Catholic Separate Schools:	5	139	126	133	135	118	118
Grande Prairie RCSSD #28							
Beaverlodge RCSSD #68							
Sexsmith RCSSD #51							
St. Thomas More RCSSD #35	1	30	32	26	21	32	43
North Peace Separate Schools	6	129	123	134	133	136	130
South East Peace Catholic Authority	5	173	154	167	142	144	134
Independent and Other Schools:							
Grovedale S.D. #4910	1	12	15	23	14	16	15
Maranatha Junior Academy	1	3	3	4	3	5	4
Peace River Junior Academy	1	10	7	6	8	5	6
Out of Zone Schools:							
Calgary S.D.	2	68	88	78	73	88	100
County of Lamont	4	112	115	141	108	145	153
County of Thorhild	1	38	47	36	37	48	48
Jasper S.D.	1	23	23	54	45	45	61
Red Deer S.D.	2	28	47	28	33	33	68
Actual totals	125	2298	2486	2117	2309	2364	2211

PARTICIPATING SCHOOL SYSTEMS WITH SCHOOL AND PUPIL COUNTS IN 1978

APPENDIX J

A SUPPLEMENTARY PRINT-OUT FOR THE CENTRAL OFFICES - GRADE FOUR

ZONE ONE

ELEMENTARY MATHEMATICS TESTING PROJECT

COORDINATOR
AL ANDERSON
5804 - 109th AVENUE
EDMONTON, ALBERTA
T6A 1S2

PERCENTAGE MEANS FOR ZONE

ZONE ONE GRADE FOUR JUNE/79

NUMBER		OPERATIONS & PROPERTIES		MEASUREMENT		GEOMETRY		GRAPHING	
1	58.7%	1	61.2%	1	63.4%	1	75.6%	1	83.9%
2	53.8%	2	43.3%	2	52.8%	2	56.2%	2	79.1%
3	50.3%	3	43.1%	3	31.6%	3	58.7%	3	64.9%
4	79.8%	4	54.4%	4	52.6%			4	49.8%
5	45.6%	5	54.0%	5	58.8%				
6	60.2%	6	70.5%	6	60.7%				
7	57.9%	7	41.3%	7	64.1%				
8	16.2%	8	49.7%	8	45.7%				
9	49.8%	9	64.0%	9	21.8%				
		10	81.0%						
AVG	52.5%		56.2%		50.2%		63.5%		69.5%

PERCENTAGE MEANS FOR ZONE

OUT OF ZONE GRADE FOUR JUNE/79

NUMBER		OPERATIONS & PROPERTIES		MEASUREMENT		GEOMETRY		GRAPHING	
1	61.8%	1	67.7%	1	64.7%	1	76.5%	1	87.9%
2	57.0%	2	47.5%	2	57.3%	2	54.6%	2	80.9%
3	55.7%	3	43.0%	3	30.3%	3	64.9%	3	66.9%
4	83.1%	4	62.3%	4	59.9%			4	51.7%
5	48.8%	5	65.2%	5	66.9%				
6	65.1%	6	80.1%	6	70.9%				
7	65.1%	7	50.0%	7	65.3%				
8	15.4%	8	60.0%	8	53.6%				
9	51.0%	9	70.2%	9	13.4%				
		10	85.2%						
AVG	55.9%		63.1%		53.6%		65.3%		71.8%

COMPARING MASTERY LEVELS OF MALES AND FEMALES

ZONE ONE GRADE FOUR JUNE/79

	NUMBER		OPERATIONS & PROPERTIES		MEASUREMENT		GEOMETRY		GRAPHING
1M	57.6%	1M	57.9%	1M	62.8%	1M	73.8%	1M	83.6%
F	59.9%	F	65.0%	F	64.0%	F	77.8%	F	84.4%
2M	51.7%	2M	40.8%	2M	54.7%	2M	56.0%	2M	77.3%
F	56.2%	F	46.0%	F	50.7%	F	56.4%	F	81.3%
3M	51.5%	3M	41.8%	3M	32.8%	3M	57.7%	3M	63.5%
F	49.0%	F	44.5%	F	30.3%	F	59.9%	F	66.6%
4M	77.8%	4M	51.4%	4M	52.4%			4M	49.5%
F	82.0%	F	57.7%	F	52.7%			F	50.2%
5M	43.5%	5M	52.7%	5M	59.1%				
F	47.9%	F	55.6%	F	58.3%				
6M	59.2%	6M	67.1%	6M	59.9%				
F	61.3%	F	74.2%	F	61.6%				
7M	54.0%	7M	39.9%	7M	64.9%				
F	62.3%	F	42.9%	F	63.2%				
8M	14.8%	8M	48.3%	8M	45.2%				
F	17.9%	F	51.3%	F	46.3%				
9M	48.0%	9M	58.8%	9M	21.5%				
F	51.8%	F	69.9%	F	22.2%				
		10M	78.9%						
		F	83.3%						
AVM	50.9%	M	53.8%	M	50.4%	M	62.5%	M	68.4%
L	54.3%	F	59.0%	F	49.9%	F	64.7%	F	70.6%

COMPARING MASTERY LEVELS OF MALES AND FEMALES

OUT OF ZONE GRADE FOUR JUNE/79

	NUMBER		OPERATIONS & PROPERTIES		MEASUREMENT		GEOMETRY		GRAPHING
1M	61.2%	1M	66.2%	1M	68.3%	1M	73.2%	1M	87.6%
F	62.6%	F	69.5%	F	60.4%	F	80.5%	F	88.2%
2M	52.9%	2M	45.6%	2M	59.3%	2M	51.6%	2M	78.5%
F	61.8%	F	49.7%	F	55.0%	F	58.2%	F	83.8%
3M	59.0%	3M	39.5%	3M	32.8%	3M	62.3%	3M	66.8%
F	51.8%	F	47.0%	F	27.3%	F	67.9%	F	66.9%
4M	80.4%	4M	60.1%	4M	63.1%			4M	52.1%
F	86.2%	F	65.0%	F	56.2%			F	51.3%
5M	47.9%	5M	64.1%	5M	66.9%				
F	49.8%	F	66.5%	F	66.8%				
6M	63.0%	6M	77.8%	6M	69.8%				
F	67.6%	F	82.8%	F	72.3%				
7M	61.0%	7M	49.1%	7M	68.4%				
F	69.9%	F	51.1%	F	61.7%				
8M	16.7%	8M	59.1%	8M	53.6%				
F	13.9%	F	61.1%	F	53.5%				
9M	53.2%	9M	66.1%	9M	13.0%				
F	48.5%	F	75.0%	F	13.9%				
		10M	84.7%						
		F	85.7%						
AVM	55.0%	M	61.2%	M	55.0%	M	62.3%	M	71.2%
L	56.9%	F	65.3%	F	51.9%	F	68.9%	F	72.6%

COMPARING MASTERY LEVELS OF EARLY AND LATE STARTERS

ZONE ONE GRADE FOUR JUNE/79

NUMBER		OPERATIONS & PROPERTIES		MEASUREMENT		GEOMETRY		GRAPHING	
1E	57.1%	1E	59.7%	1E	62.5%	1E	73.7%	1E	82.1%
L	63.5%	L	64.5%	L	66.2%	L	79.0%	L	87.5%
2E	51.2%	2E	40.5%	2E	51.7%	2E	53.1%	2E	76.9%
L	58.7%	L	49.3%	L	55.8%	L	60.7%	L	82.9%
3E	48.4%	3E	41.1%	3E	29.7%	3E	57.0%	3E	62.0%
L	54.8%	L	47.3%	L	35.1%	L	61.9%	L	70.6%
4E	78.9%	4E	53.1%	4E	51.6%			4E	46.9%
L	81.9%	L	57.0%	L	54.7%			L	54.2%
5E	42.2%	5E	51.7%	5E	56.8%				
L	51.4%	L	56.7%	L	62.3%				
6E	57.9%	6E	68.6%	6E	58.3%				
L	65.6%	L	74.1%	L	65.1%				
7E	56.6%	7E	39.6%	7E	62.1%				
L	61.0%	L	44.8%	L	67.7%				
8E	13.4%	8E	47.5%	8E	44.2%				
L	22.3%	L	53.8%	L	48.8%				
9E	46.1%	9E	61.2%	9E	19.7%				
L	57.2%	L	69.6%	L	24.3%				
		10E	80.2%						
		L	83.0%						
AVE	50.2%	E	54.3%	E	48.5%	E	61.3%	E	67.0%
L	57.4%	L	60.2%	L	53.3%	L	67.2%	L	73.8%

COMPARING MASTERY LEVELS OF EARLY AND LATE STARTERS

OUT OF ZONE GRADE FOUR JUNE/79

NUMBER		OPERATIONS & PROPERTIES		MEASUREMENT		GEOMETRY		GRAPHING	
1E	60.5%	1E	67.3%	1E	62.3%	1E	73.8%	1E	86.8%
L	63.5%	L	68.0%	L	68.2%	L	80.4%	L	89.5%
2E	56.9%	2E	48.3%	2E	56.2%	2E	54.6%	2E	80.3%
L	57.5%	L	46.7%	L	59.0%	L	54.2%	L	81.8%
3E	51.8%	3E	42.2%	3E	29.5%	3E	64.1%	3E	65.5%
L	61.5%	L	44.3%	L	31.7%	L	66.0%	L	68.5%
4E	83.0%	4E	61.4%	4E	60.1%			4E	52.6%
L	83.0%	L	63.8%	L	59.8%			L	50.5%
5E	45.9%	5E	64.1%	5E	66.3%				
L	53.5%	L	66.6%	L	68.1%				
6E	64.1%	6E	79.5%	6E	70.6%				
L	66.2%	L	80.9%	L	71.8%				
7E	64.1%	7E	50.6%	7E	64.1%				
L	66.4%	L	49.3%	L	67.4%				
8E	14.3%	8E	57.0%	8E	54.0%				
L	17.2%	L	64.4%	L	53.0%				
9E	51.1%	9E	70.1%	9E	12.9%				
L	51.3%	L	70.0%	L	14.3%				
		10E	83.8%						
		L	87.2%						
AVE	54.6%	E	62.4%	E	52.9%	E	64.2%	E	71.3%
L	57.8%	L	64.1%	L	54.8%	L	66.9%	L	72.6%